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Javelin–
Close Combat Missile System, Medium

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Headquarters, Department of the Army

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PREFACE

This publication provides technical information, training techniques, and guidance on the current Javelin weapon system and Block 1 improvements. The intended users include unit leaders, trainers, and designated gunners. The users will find this information invaluable in their efforts to successfully integrate this weapon system into their combat operations.

This publication applies to the Active Army, the Army National Guard (ARNG)/National Guard of the United States (ARNGUS), and the US Army Reserve (USAR).

Terms that have joint or Army definitions are identified in both the Glossary and the text. Terms, for which TC 3-22.37 is the proponent FM, are indicated with an asterisk in the Glossary.

Uniforms depicted in this manual were drawn without camouflage for clarity of the illustration. Unless this publication states otherwise, masculine nouns and pronouns refer to both men and women.

The proponent for this publication is the U.S. Army Training and Doctrine Command (TRADOC). The preparing agency is the U.S. Army Maneuver Center of Excellence (MCoE). Send comments and recommendations by any means, U.S. mail, e-mail, fax, or telephone, using the format of DA Form 2028, *Recommended Changes to Publications and Blank Forms*. Point of contact information is as follows.

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Chapter 1

INTRODUCTION

The Javelin surface-attack guided missile and launcher is a fire-and-forget, man-portable medium close combat missile system consisting of a command launch unit (CLU) and a round. The Javelin is operated by an individual Soldier or in crews of two or three. Soldiers can use the Javelin during the day, at night, and during limited visibility conditions.

WEAPON SYSTEM

1-1. The Javelin weapon system consists of a Javelin, a basic skills trainer (BST), a field tactical trainer (FTT), and a missile simulation round (MSR).

JAVELIN

1-2. The Javelin is a fire-and-forget, shoulder-fired weapon that consists of a reusable M98A1 CLU and a round. The CLU houses the daysight, night vision sight (NVS), controls, and indicators. The round consists of the missile, the launch tube assembly (LTA) (Figure 1-1), and the battery coolant unit (BCU). The missile contains the guidance section, mid-body section, warhead section, propulsion section, and control actuator section. The LTA serves as the launch platform and carrying container for the missile.

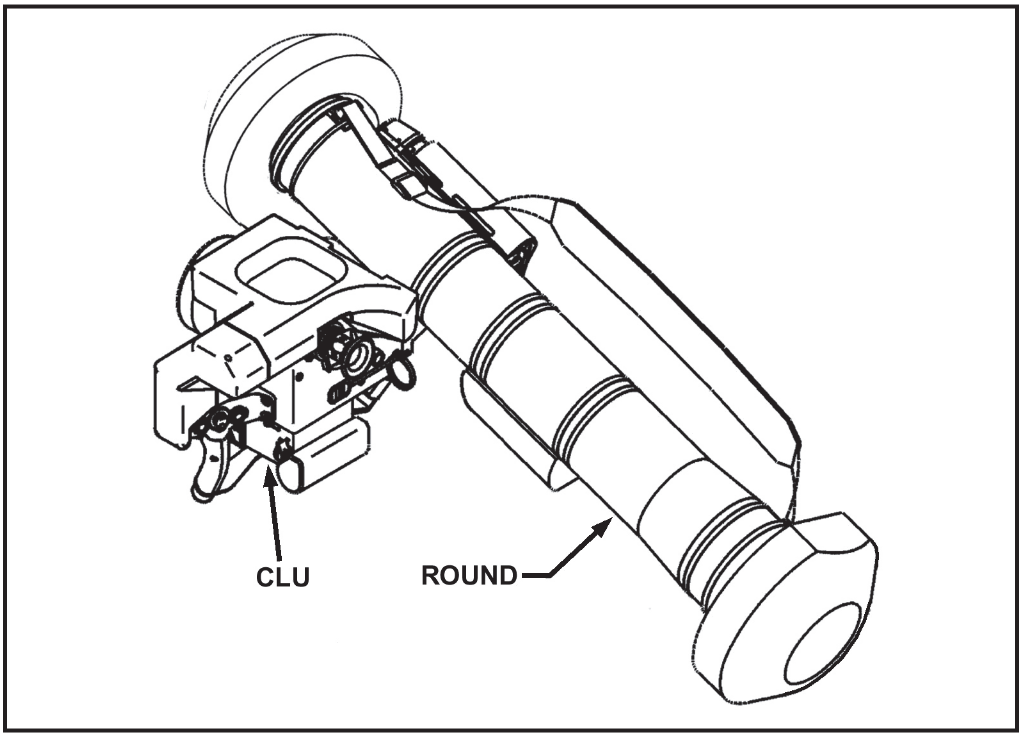

Figure 1-1. Javelin.

BASIC SKILLS TRAINER

1-3. The BST is an indoor training device that consists of a Soldier station and an instructor station (Figure 1-2). The Soldier station consists of a simulated command launch unit (SCLU) and an MSR. The instructor station has a desktop computer, a monitor, a keyboard, a mouse, an interconnect cable, and a surge suppressor. BST training exercises use real terrain models, actual visible and infrared (IR) imagery, and matching three-dimensional target models for natural target movements. The gunner sees a realistic simulated battlefield environment.

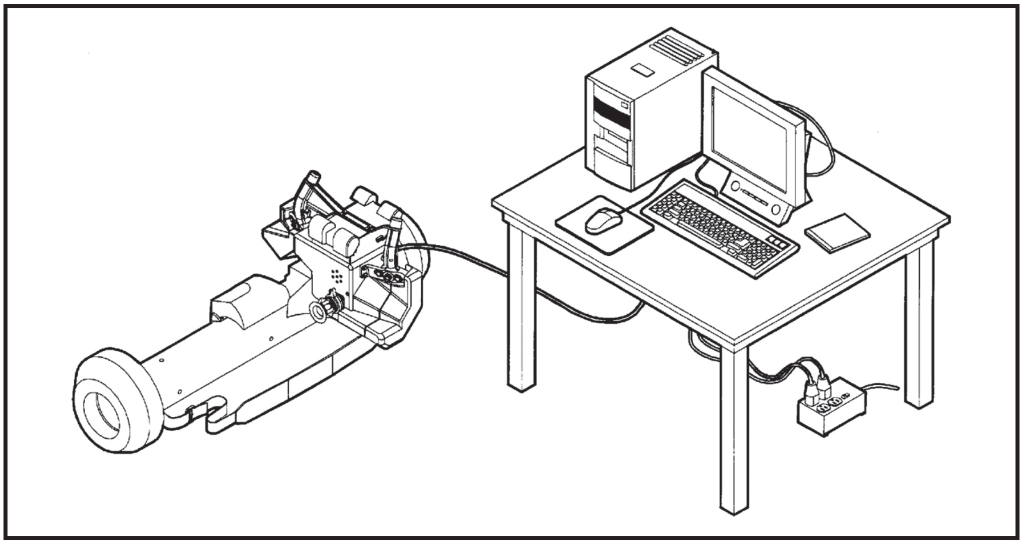

Figure 1-2. Basic skills trainer.

FIELD TACTICAL TRAINER

1-4. The FTT is an outdoor force-on-force trainer used in conjunction with a tactical CLU and a simulated round. The FTT consists of an instructor station, which is used to monitor the student (Figure 1-3). The simulated round is equipped with a multiple integrated laser engagement system (MILES).

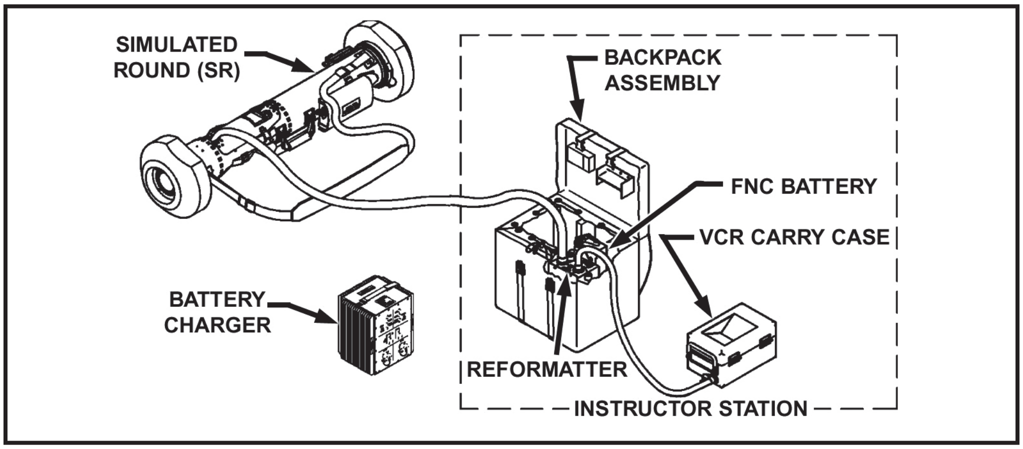
SIMULATED ROUND (SR)
BACKPACK ASSEMBLY
FNC BATTERY
VCR CARRY CASE
BATTERY CHARGER
REFORMATTER
INSTRUCTOR STATION

Figure 1-3. Field tactical trainer.

MISSILE SIMULATION ROUND

1-5. The MSR is a field handling round with a simulated launch tube (Figure 1-4). It replicates the weight and balance of the actual round. The FTT contains no instruments or circuitry and is used to train gunners on how to maintain, handle, and carry the round.

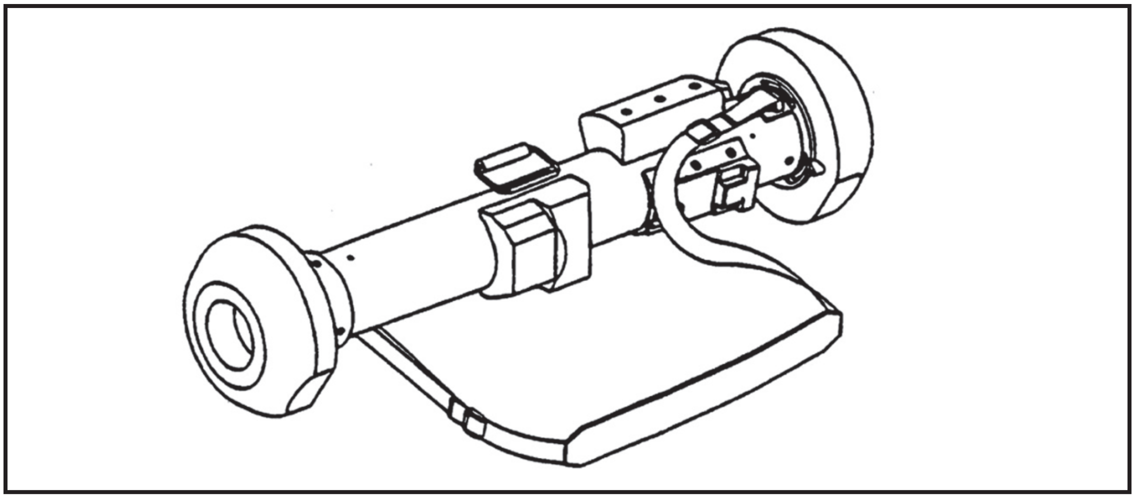

Figure 1-4. Missile simulation round.

EQUIPMENT DESCRIPTION AND DATA

1-6. Tables 1-1 through 1-3 show the Javelin's capabilities and features, the CLU's physical characteristics, and the round's physical characteristics.

Table 1-1. Javelin capabilities and features.

Type of System	Fire and forget	
Crew	One- to three-Soldier teams based on table of organization and equipment (TOE)	
Missile Modes	Top attack (default) Direct attack	
Ranges	Top attack mode minimum effective engagement	150 m
	Maximum effective engagement range (direct attack and top attack modes)	2,000 m
	Direct attack mode minimum effective engagement range	65 m
Flight Time	About 14 seconds at 2,000 meters	
Backblast Area (See Figure 1-11 and Appendix A for safety factors.)	Primary danger zone extends out 25 m at a 60-degree (cone-shaped) angle.	
	Caution zone extends the cone-shaped area out to 100 m	
Propulsion (Two-Stage Motor)	Launch motor ejects the missile from the LTA	
	Flight motor propels the missile to the target	
Firing From Inside Enclosures	Minimum room length	15 ft
	Minimum room width	12 ft
	Minimum room height	7 ft

Table 1-2. Physical characteristics of the command launch unit.

M98A1 CLU	With Battery, Carrying Bag, and Cleaning Kit	
	Weight	14.16 lb (6.42 kg)
	Length	13.71 in (34.82 cm)
	Height	13.34 in (33.88 cm)
	Width	19.65 in (49.91 cm)
	Carrying Bag Only	
	Weight	0.60 lb (0.27 kg)
Sights	Daysight	
	Magnification	4x
	Field-of-view (FOV)	4.80° x 6.40°
	NVS	
	Wide field-of-view (WFOV) magnification	4.2x
	WFOV	4.58° x 6.11°
	Narrow field-of-view (NFOV) magnification	9.2x
	NFOV	2.00° x 3.00° (approximately)
Battery	Battery type	Lithium sulfur dioxide BA-5590/U (Non-rechargeable)
	Number required	1
	NSN	6135-01-036-3495
	Weight	2.2 lb (1.00 kg)
	Life	4.0 hr below 120°F (49°C)
		3.0 hr between 50°F to 120°F (10°C to 49°C)
		1.0 hr between -20°F to 50°F (-49°C to 10°C)
		0.5 hr above 120°F (49°C)

Table 1-3. Physical characteristics of the round.

Complete Round (LTA with missile and BCU)	Weight	35.14 lb (15.97 kg)
	Length	47.60 in (120.90 cm)
	Diameter with end caps	11.75 in (29.85 cm)
	Inside diameter	5.52 in (14.00 cm)
BCU	Weight	2.91 lb (1.32 kg)
	Length	8.16 in (20.73 cm)
	Width	4.63 in (11.75 cm)
	Battery	
	Type	Lithium, non-rechargeable
	Life	4 min of BCU time
	Coolant gas	Argon

1-7. Figure 1-5 shows the Javelin backblast danger area. The primary danger area is a 60-degree sector, with the apex of the sector at the aft end of the missile launch motor. For more safety information, see Appendix A.

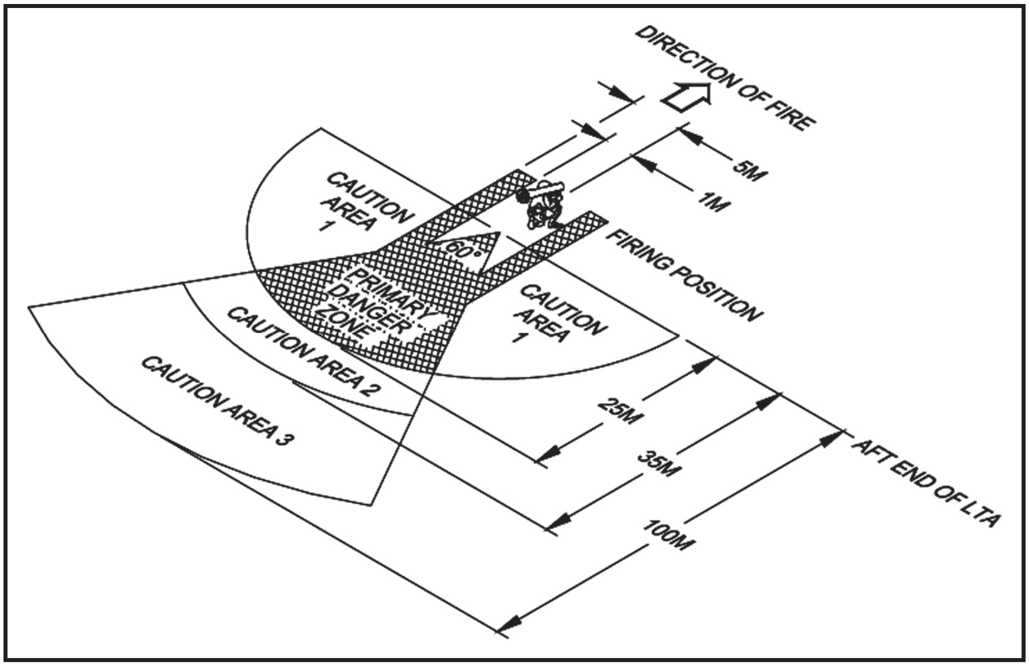
DIRECTION OF FIRE
5M
1M
FIRING POSITION
CAUTION AREA 1
60°
PRIMARY DANGER ZONE
CAUTION AREA 1
CAUTION AREA 2
CAUTION AREA 3
25M
35M
100M
AFT END OF LTA

Figure 1-5. Javelin backblast safety zones.

COMMAND LAUNCH UNIT

1-8. The M98A1 CLU attaches to the LTA, the only reusable portion of the Javelin system (Figure 1-6). It consists of a main housing, shock absorbers, handgrips, battery compartment, daysight, NVS, eyepiece, test connector, and round interface connector.

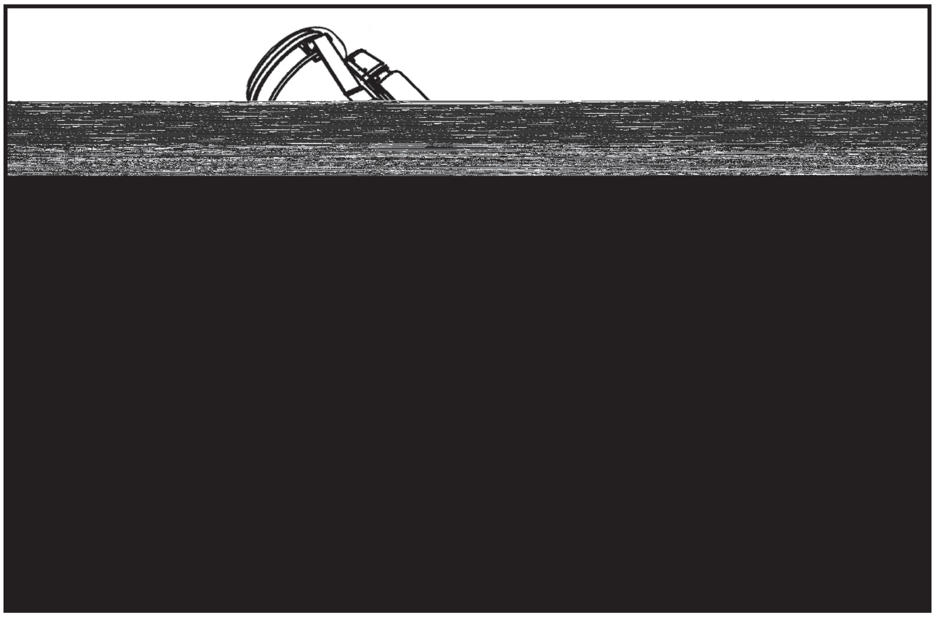

Figure 1-6. Javelin components.

MAIN HOUSING

1-9. The main housing (body) of the CLU (Figure 1-7) contains the system's electronics, the display, daysight, and NVS.

ABSORBERS

1-10. The absorbers (Figure 1-7) around the main housing of the CLU help protect the equipment during operation. The absorbers are replaceable. One absorber is a face shield that protects the gunner's face during missile launch.

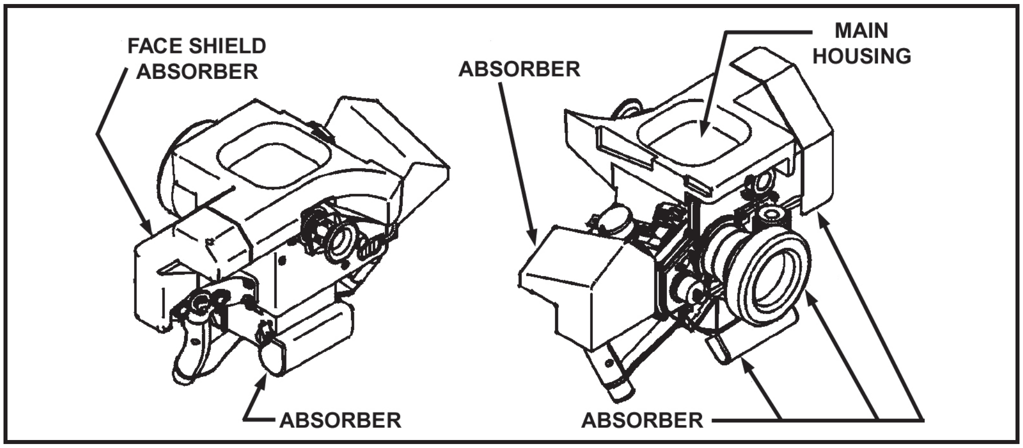

Figure 1-7. Main housing and absorbers.

HANDGRIPS

1-11. The gunner uses the handgrips attached to the sides of the main housing (Figure 1-8) to hold the CLU. The gunner uses the controls on the handgrips for all Javelin operations.

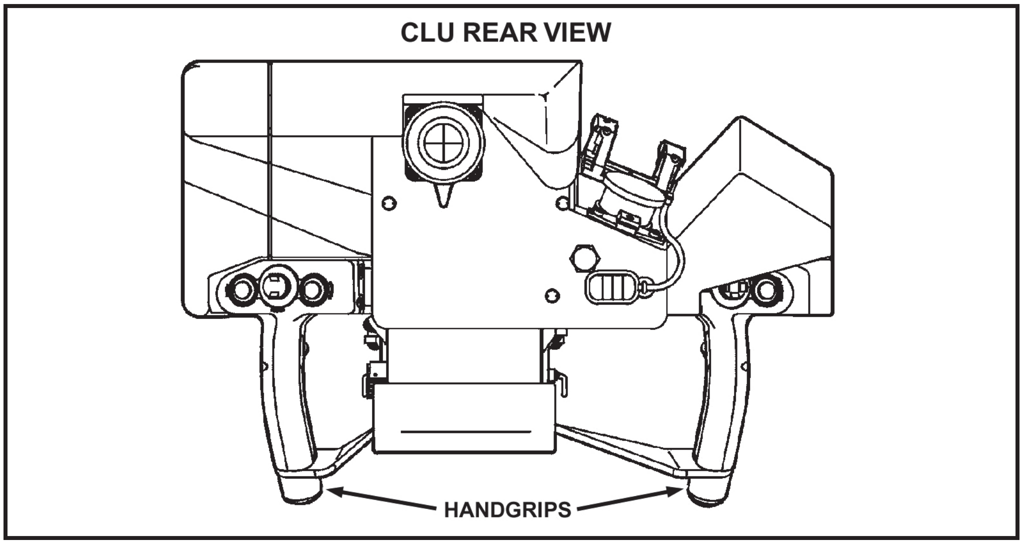

Figure 1-8. Handgrips.

BATTERY COMPARTMENT

1-12. Located on the bottom of the main housing, the battery compartment (Figure 1-9) houses the nonrechargeable BA-5590/U or the rechargeable BB390A battery (for training use only). The same battery is used in the single-channel ground and airborne radio system (SINCGARS) and can be interchanged with the CLU. A connector on the battery compartment joins to a corresponding connector on the battery. A wire bail holds the detachable battery compartment cover in place.

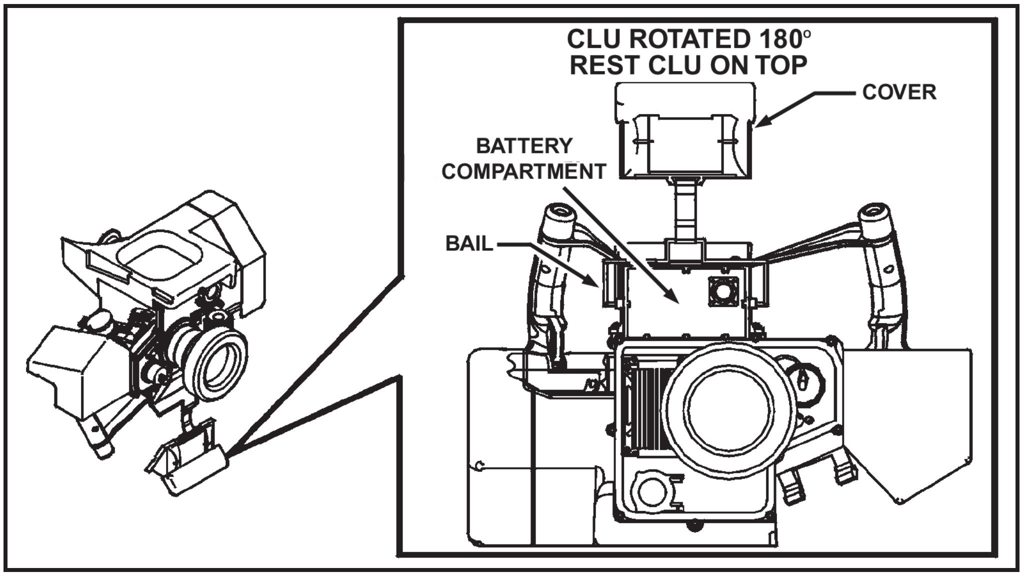

Figure 1-9. Battery compartment.

DAYSIGHT

1-13. The daysight works much like a telescope and consists of a lens, status indicators, and an eyepiece (Figure 1-10). The daysight—

- Provides the gunner visible light imagery with 4x magnification for target viewing and battlefield surveillance.
- Can be used with the power off for surveillance to conserve battery life.
- Is not affected by IR clutter.

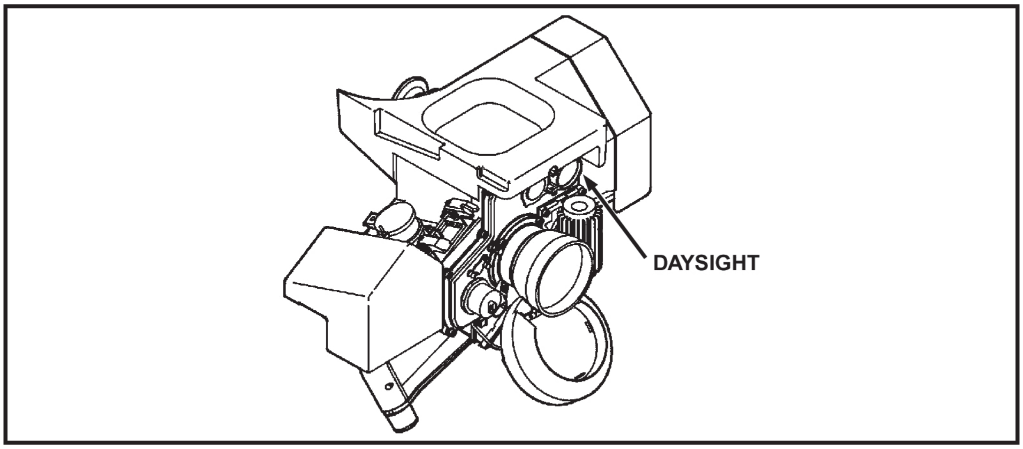

Figure 1-10. Daysight.

NIGHT VISION SIGHT

1-14. The NVS is the primary sight used by the gunners (Figure 1-11) during the day or night. This imaging infrared (I2R) system allows the gunner to see during limited visibility conditions, including darkness, obscuration, smoke, fog, inclement weather, and IR clutter. The NVS operates by converting an IR target image to a visible light image for the gunner. The NVS consists of the NVS lens, a detector dewar cooler (DDC), a CLU display, and an eyepiece that provides the gunner with both 4x wide field-of-view (WFOV) and 9x narrow field-of-view (NFOV) magnification for scanning and target detection.

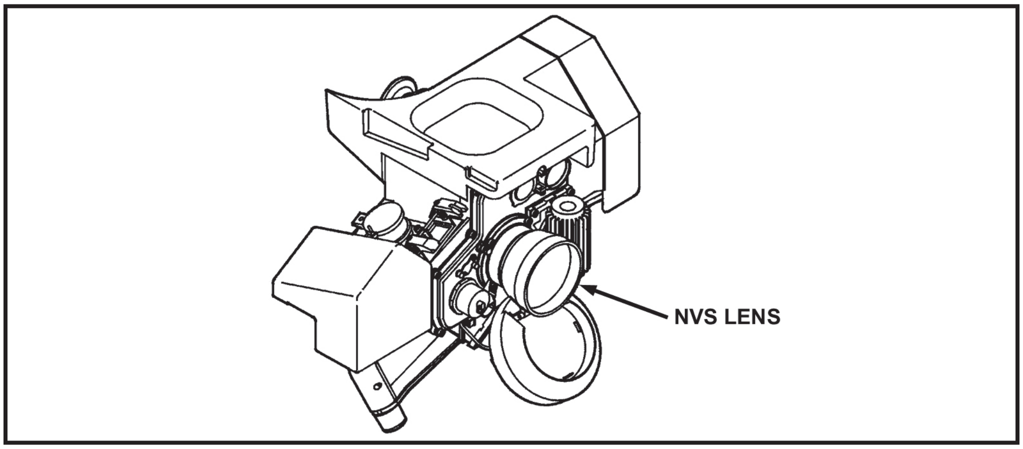

Figure 1-11. Night vision sight lens.

Detector Dewar Cooler

1-15. The DDC (Figure 1-12) cools the NVS to the proper operating temperature and converts IR energy to electrical signals. These signals are sent to the CLU display by way of the signal processor to provide the gunner a picture of the target area.

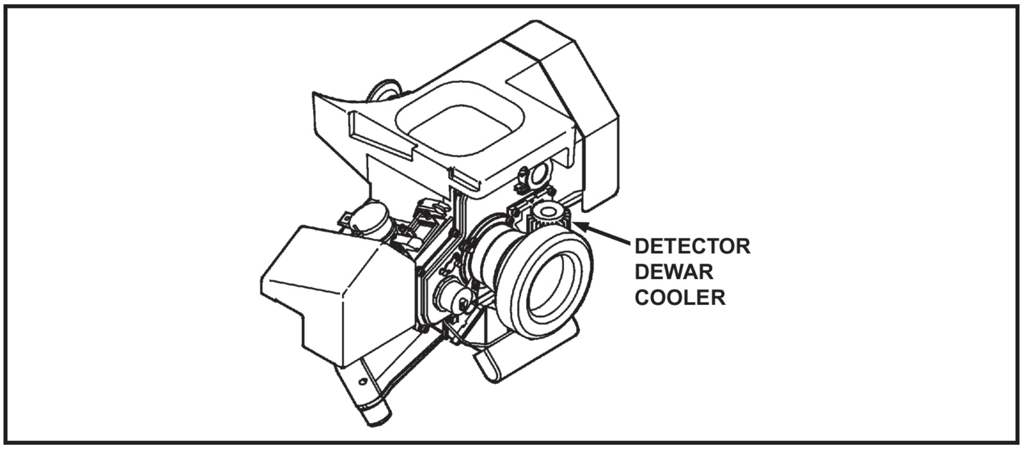

Figure 1-12. Detector dewar cooler.

Command Launch Unit Display

1-16. Similar to a miniature television, the CLU display is used to make the WFOV, NFOV, and seeker IR images visible to the gunner.

1-17. The green, amber, and red icon indicators (Figure 1-13) that surround the CLU display identify operational modes, conditions, and malfunctions. Visible during day and night use, these indicators provide the gunner with continuous feedback on missile readiness or possible system malfunctions. All indicators will be explained in detail in Chapter 2.

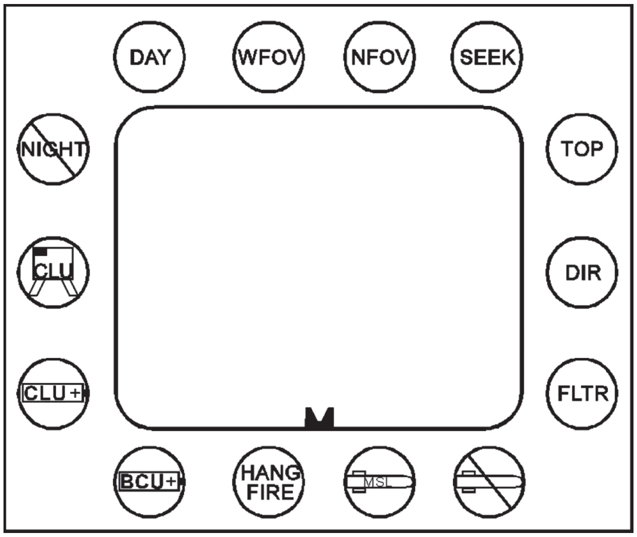
DAY
WFOV
NFOV
SEEK
NIGHT
TOP
CLU
DIR
CLU+
FLTR
BCU+
HANG FIRE
MSL

Figure 1-13. Status indicators.

Eyepiece

1-18. The eyepiece (Figure 1-14) allows the gunner to see the CLU display. Through the eyepiece, the gunner sees the DAY FOV, WFOV, NFOV, seeker FOV, and the status indicators. The eyepiece consists of a lens assembly, eyecup, and diopter adjust ring.

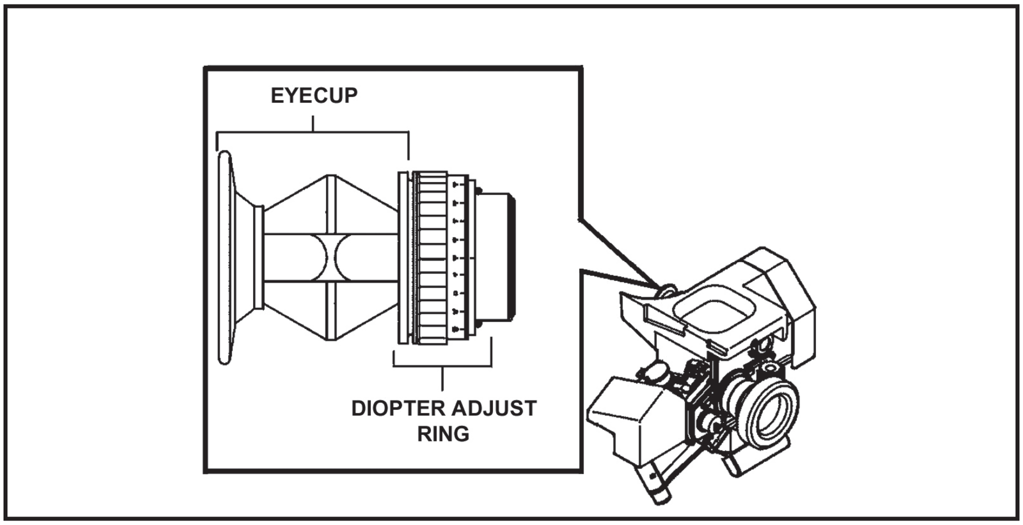
EYECUP
DIOPTER ADJUST RING

Figure 1-14. Eyepiece.

Test Connector

1-19. The test connector (Figure 1-15) is used to perform field- or higher-level maintenance and to interface with the FTT.

Round Interface Connector

1-20. The round interface connector (Figure 1-15) provides the electrical connection between the CLU and the round.

Humidity Indicator

1-21. The humidity indicator (Figure 1-15) displays the quality of the air inside the CLU (white or blue within acceptable levels; pink requires maintenance).

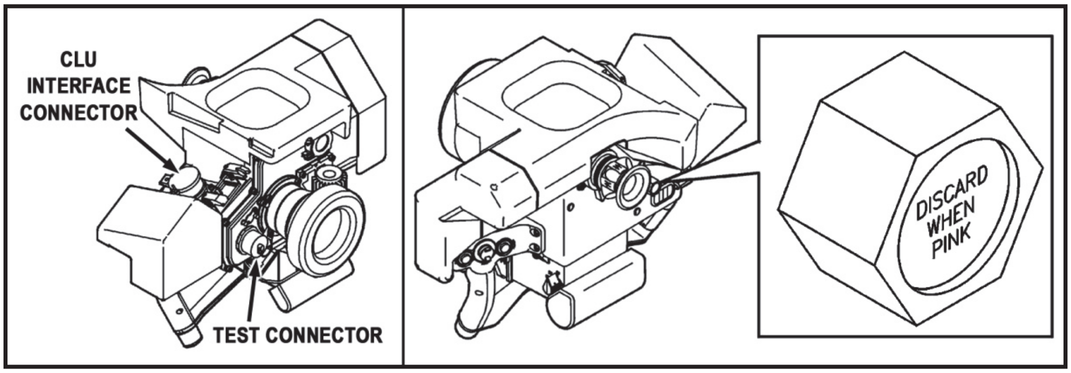

Figure 1-15. Test connector, round interface connector, and humidity indicator.

ROUND

1-22. The round consists of the LTA, the BCU, and the missile (Figure 1-16). The LTA interfaces with the CLU and serves both as a handling container and launch platform for the missile. The LTA consists of a launch tube, forward and aft end caps, carry handle, shoulder strap, CLU interface connector, and shoulder pad.

NOTE: The round has a 10-year shelf life. The only maintenance requirement is stockpile surveillance.

LAUNCH TUBE

1-23. The launch tube houses the missile. It is a single-piece, composite graphite/epoxy design. The launch tube protects the missile from the environment before the missile is launched. All other LTA components mount externally on the tube.

NOTE: Once the missile is launched, the LTA is discarded.

END CAPS

1-24. Two end caps protect the missile from damage during transport and handling.

Forward End Cap

1-25. The forward end cap (Figure 1-16) protects the seeker dome from moisture, dust, and other elements that could harm it. The forward end cap is removed when preparing for launch. The pressure release valve is used to reduce the pressure in the LTA so the forward end cap can be removed.

NOTE: If the missile is not fired, ensure that the LTA is clear of debris, and replace the forward end cap to protect the seeker dome.

Aft End Cap

1-26. The aft end cap (Figure 1-16) is permanently attached to the LTA. The center of the cap is blown out by the launch motor blast during launch.

CARRY HANDLE

1-27. The carry handle (Figure 1-16) is used to lift and carry the round.

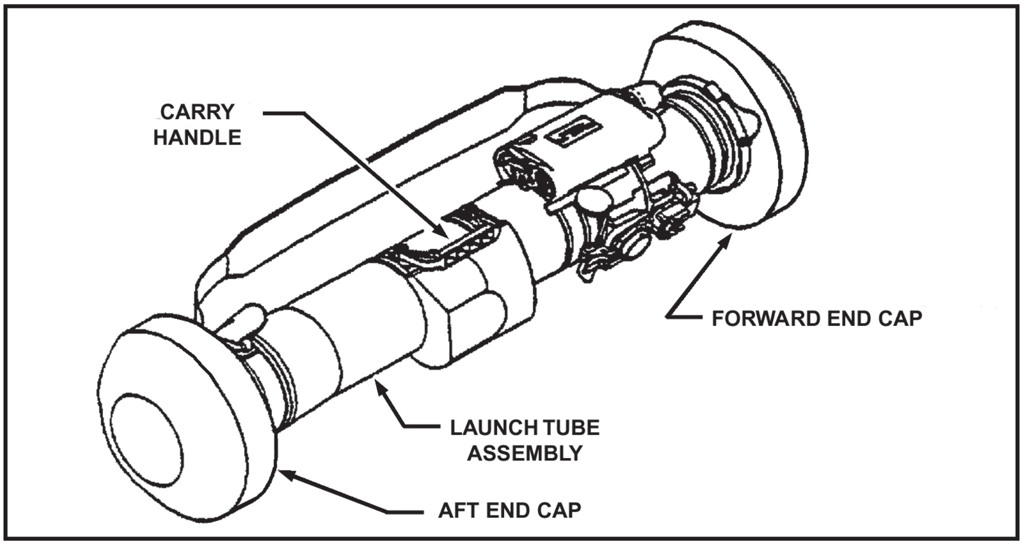
CARRY HANDLE
FORWARD END CAP
LAUNCH TUBE ASSEMBLY
AFT END CAP

Figure 1-16. Launch tube assembly, end caps, and carry handle.

SHOULDER STRAP

1-28. The adjustable shoulder strap (Figure 1-17) provides a means for carrying the round.

SHOULDER PAD

1-29. The shoulder pad (Figure 1-17) provides balance and support when the round is placed on the gunner's shoulder.

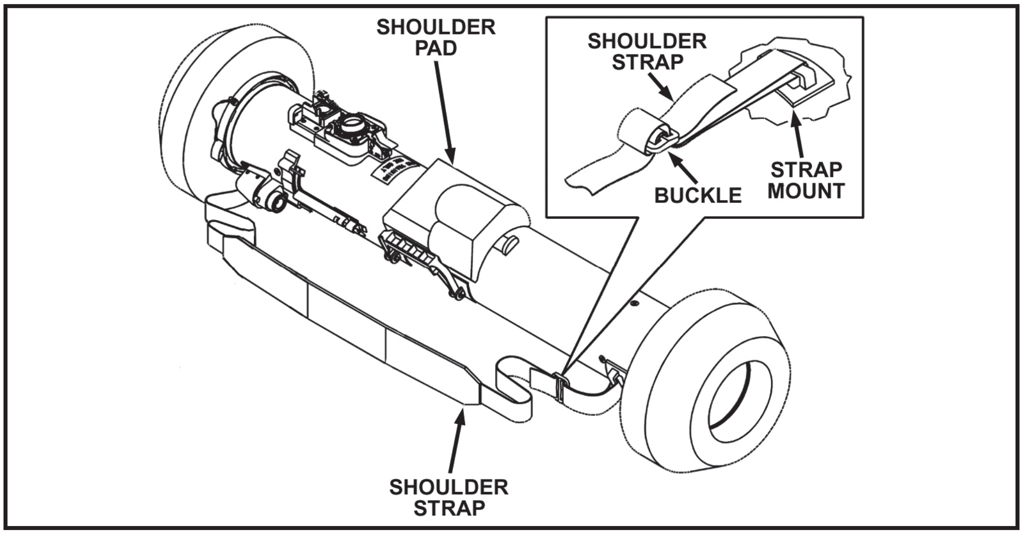
SHOULDER PAD
SHOULDER STRAP
STRAP MOUNT
BUCKLE
SHOULDER STRAP

Figure 1-17. Shoulder strap and pad.

COMMAND LAUNCH UNIT INTERFACE CONNECTOR

1-30. The CLU interface connector (Figure 1-18) provides the electrical interface between the round and CLU. Signals are passed through the connector between the CLU and round, which includes: digital information, power, and seeker image signals.

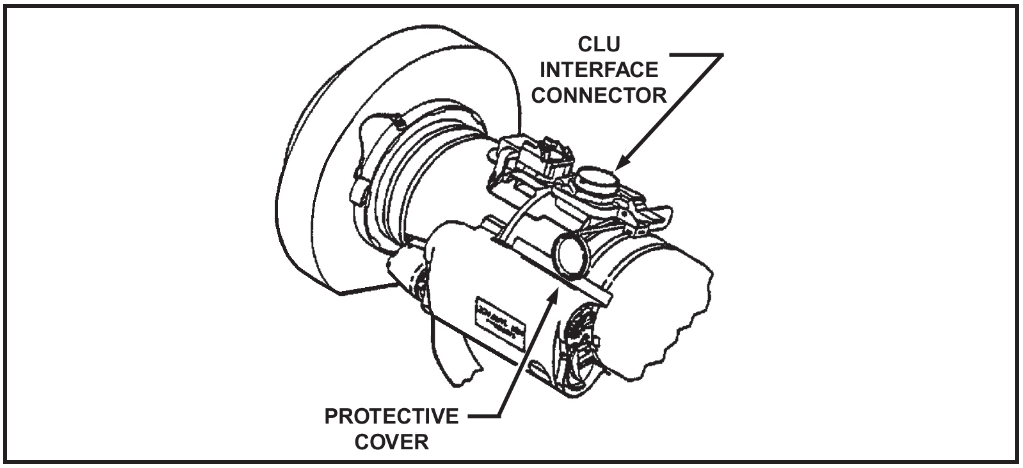

Figure 1-18. Command launch unit interface connector.

BATTERY COOLANT UNIT

1-31. The BCU (Figure 1-19) consists of a battery section and a compressed-gas coolant section. Before missile launch, the battery section powers the missile electronics, and the coolant section cools the missile seeker to its operating temperature. The BCU is a single-use unit with 4 minutes of operating time; it is not rechargeable. Once the missile has been fired, the spent BCU is discarded with the LTA.

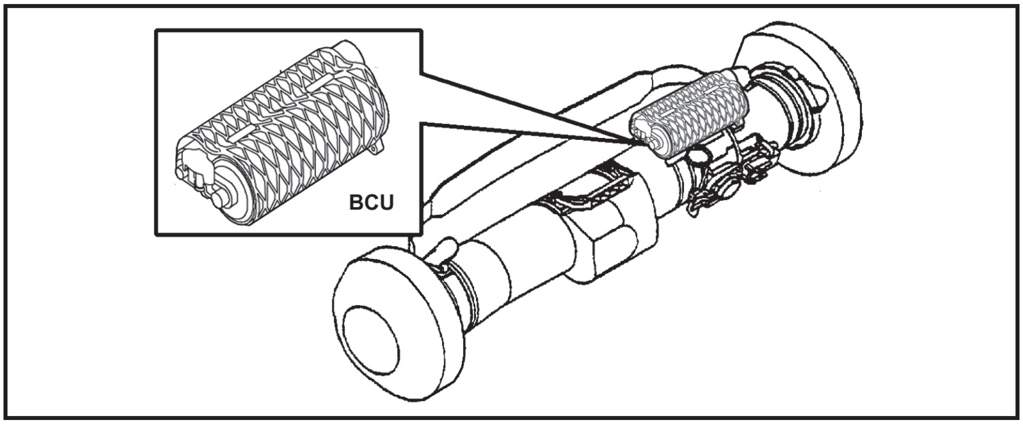

Figure 1-19. Battery coolant unit.

MISSILE

1-32. The Javelin missile is environmentally sealed in the LTA (Figure 1-20).

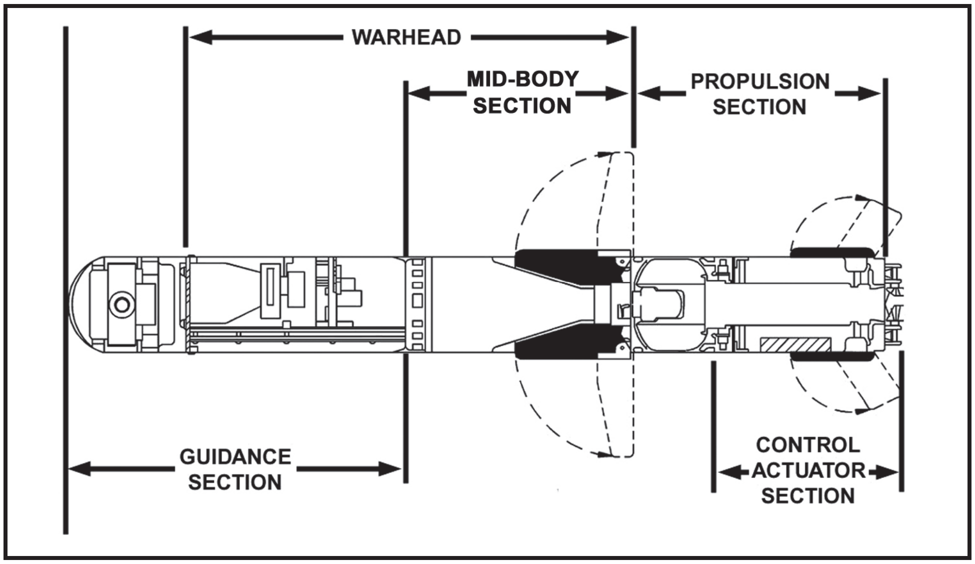

Figure 1-20. Javelin missile.

MISSILE OPERATION

1-33. The missile consists of the guidance section, the mid-body section, the warhead, the propulsion section, and the control actuator section (Figure 1-21).

GUIDANCE SECTION

1-34. The guidance section (Figure 1-21) provides target tracking and flight control signals. It is the forward section of the missile and includes the seeker head section and the guidance electronics unit.

Seeker Head

1-35. The seeker head section, known as the seeker, contains the missile I2R system and the contact switches used to detonate the warhead. The missile I2R system gives the missile its fire-and-forget capability. During flight to the target, the missile I2R system tracks the target and sends target location information to the onboard guidance electronics unit.

Guidance Electronics Unit

1-36. The guidance electronics unit serves two functions. It controls the seeker head so that it *looks* at the target, and it sends signals to the control actuator section to guide the missile to the target during flight.

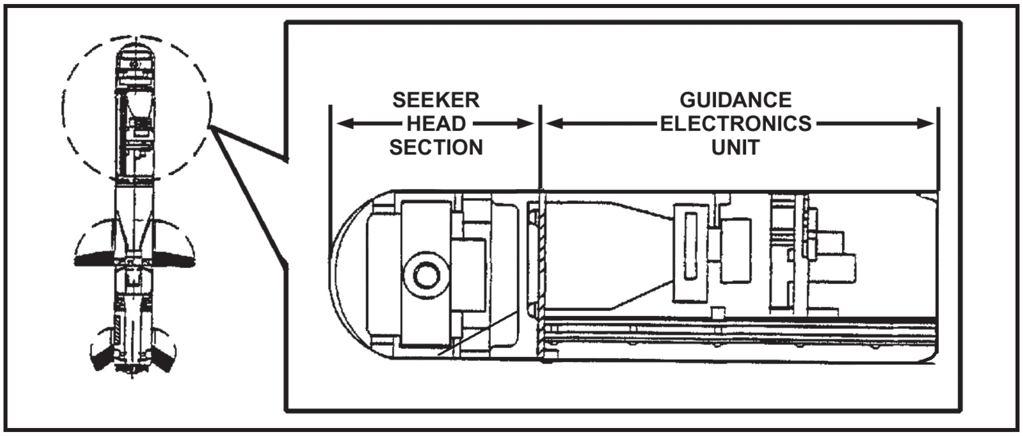

Figure 1-21. Missile guidance section.

MID-BODY SECTION

1-37. The mid-body section includes the missile skin; electronic safe, arm, and fire unit (ESAF); wings; and the main charge of the warhead (Figure 1-22).

Missile Skin

1-38. The missile skin is a structural part of the missile and provides environmental protection for the internal components during flight.

Electronic Safe, Arm, and Fire

1-39. The ESAF is the principal safety device that prevents accidental ignition of the motors and accidental warhead detonation. The ESAF consists of circuits and two detonators (one for the precursor and one for the main charge). The ESAF controls missile launch sequence and warhead detonation. It permits starting the rocket motors in the proper sequence when the gunner pulls the fire trigger and all other firing conditions have been met. When the missile hits the target, the ESAF detonates each warhead charge in sequence.

Wings

1-40. The wings provide lift and keep the missile stabilized during flight. The wings fold into slots in the missile skin when the missile is in the LTA and deploy into flight position after clearing the LTA.

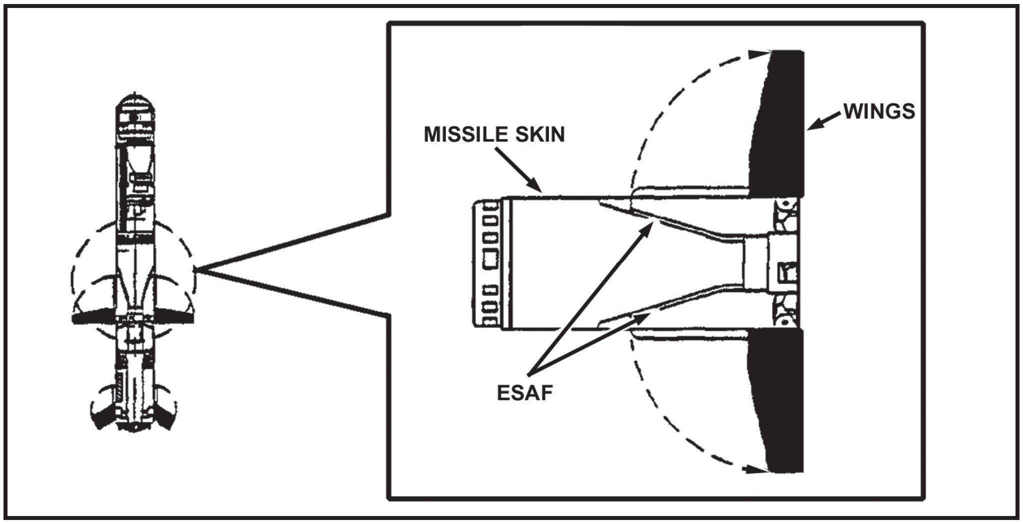

Figure 1-22. Mid-body section.

WARHEAD SECTION

1-41. The Javelin missile uses a dual-charged warhead (Figure 1-23). The warhead has a precursor charge and a main charge.

Precursor Charge

1-42. The precursor charge is a high-explosive (HE) shaped charge. Its purpose is to cause the target's reactive armor to detonate before the main charge reaches the armor. Once the reactive armor is penetrated, the target's main hull is exposed to the warhead's main charge. If the target is not equipped with reactive armor, the precursor charge provides additional explosives to penetrate the main armor.

Main Charge

1-43. The main charge is the second charge of a dual-charge warhead and is also an HE shaped charge. The primary warhead charge is designed to penetrate the target's main armor to achieve a target kill.

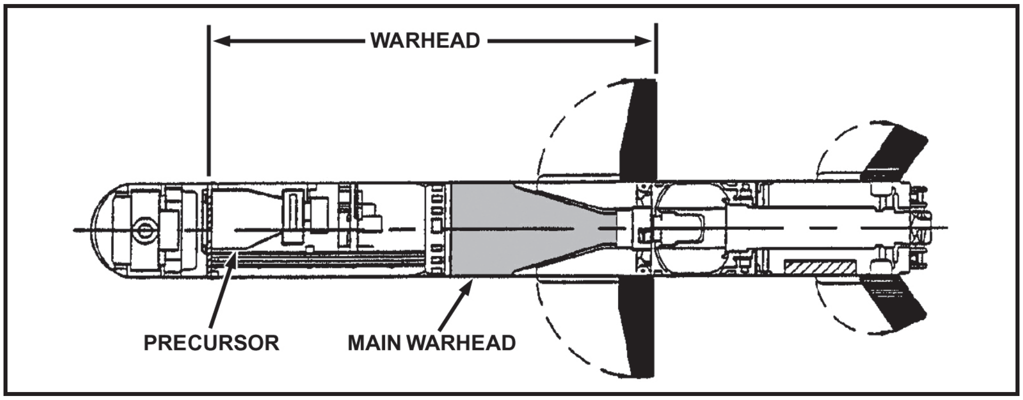

Figure 1-23. Missile warhead.

PROPULSION SECTION

1-44. The propulsion section (Figure 1-24) consists of the launch and flight motors.

Launch Motor

1-45. The launch motor propels the missile out of the LTA. It provides the initial force to push the missile a safe distance from the gunner before the flight motor ignites to ensure the gunner's safety. The launch motor is completely spent by the time the missile clears the LTA, this accounts for the low signature after launch.

Flight Motor

1-46. The flight motor powers the missile to the target during flight. It ignites when the missile is a safe distance from the gunner, protecting the gunner from hot exhaust gases generated when the motor fires.

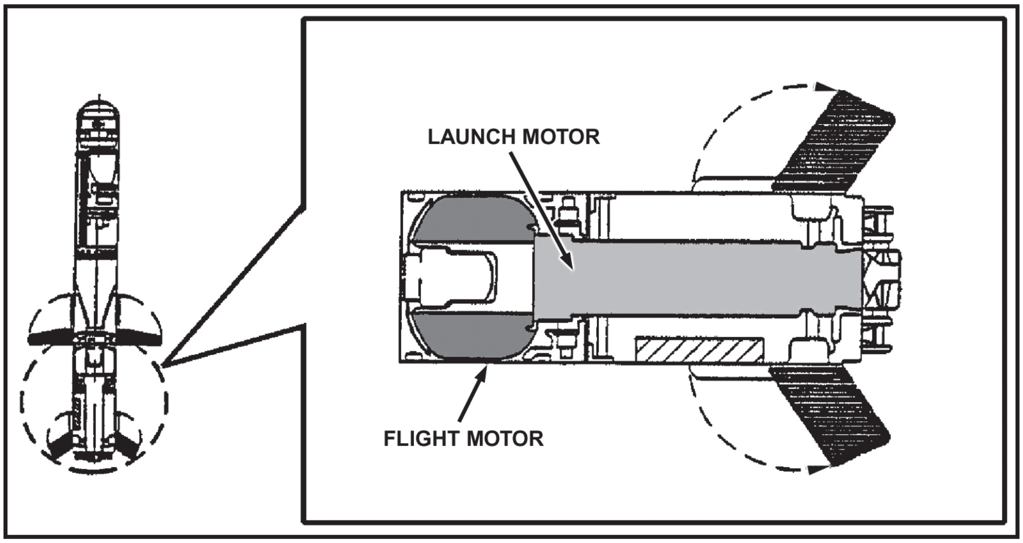

Figure 1-24. Missile propulsion section.

CONTROL ACTUATOR SECTION

1-47. The control actuator section (Figure 1-25) maneuvers the missile during flight and provides internal electrical power. The control actuator section consists of four control fins, four thrust vector control (TVC) vanes, and a thermal battery.

Control Fins

1-48. The control fins maneuver the missile during flight. The spring-loaded fins automatically deploy and lock into flight position after the missile clears the LTA. During flight, they adjust automatically to guide the missile to the target.

Thrust Vector Control Vanes

1-49. The TVC vanes aid the control fins in maneuvering the missile during flight by deflecting the flight motor exhaust. This control changes the angle of thrust from the flight motor, resulting in a change to the missile's flight path.

Thermal Battery

1-50. The thermal battery provides internal electrical power for the missile during flight. It is sealed in the body of the missile.

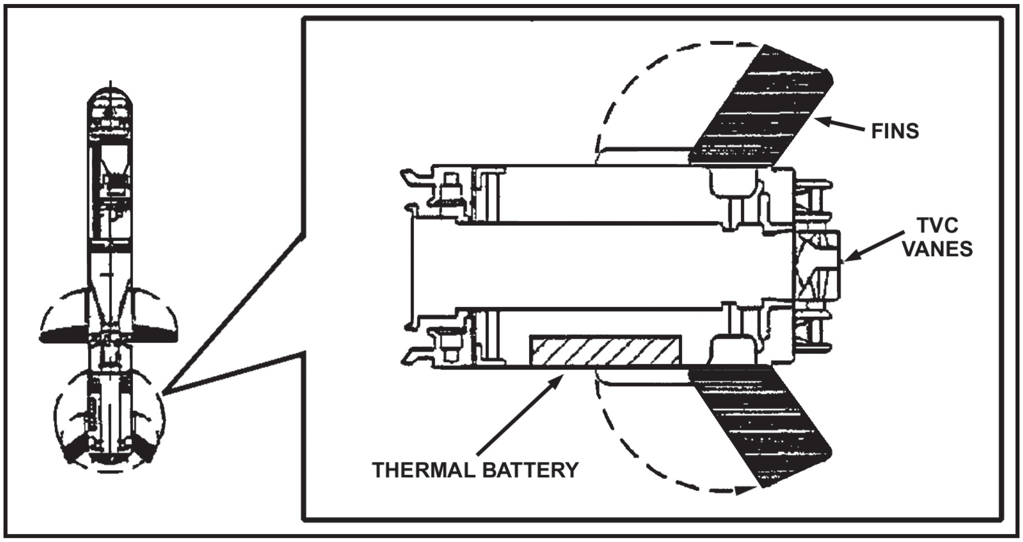

Figure 1-25. Control actuator section.

CAPABILITIES AND FEATURES

1-51. The missile has two gunner-selectable attack modes: top or direct. Each mode has its own flight path or profile for reaching the target.

TOP ATTACK MODE

1-52. The top attack is the default mode when the missile seeker is first activated. In the top attack mode, the missile approaches from above to impact and detonate on the top of the target (Figure 1-26). This capacity allows the gunner to attack a vehicle from the front, rear, or the side and greatly increases the probability of a kill. Vehicles usually have less protection on top. The minimum engagement distance is 150 meters.

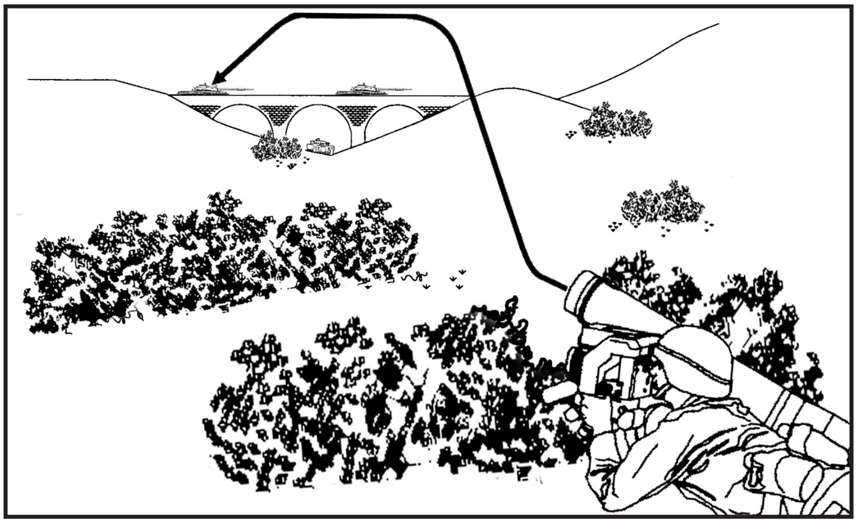

Figure 1-26. Top attack mode.

1-53. The exact profile of the missile flight path depends on the range to the target and is determined automatically by the missile's onboard software). When firing at a 2,000-meter target, the missile reaches a height of about 160 meters above the battlefield (Figure 1-27). If the target is under a protective structure, using the top attack mode will cause the missile to detonate on the structure instead of on the target. The gunner can select the direct attack mode to counter targets hiding under protective cover.

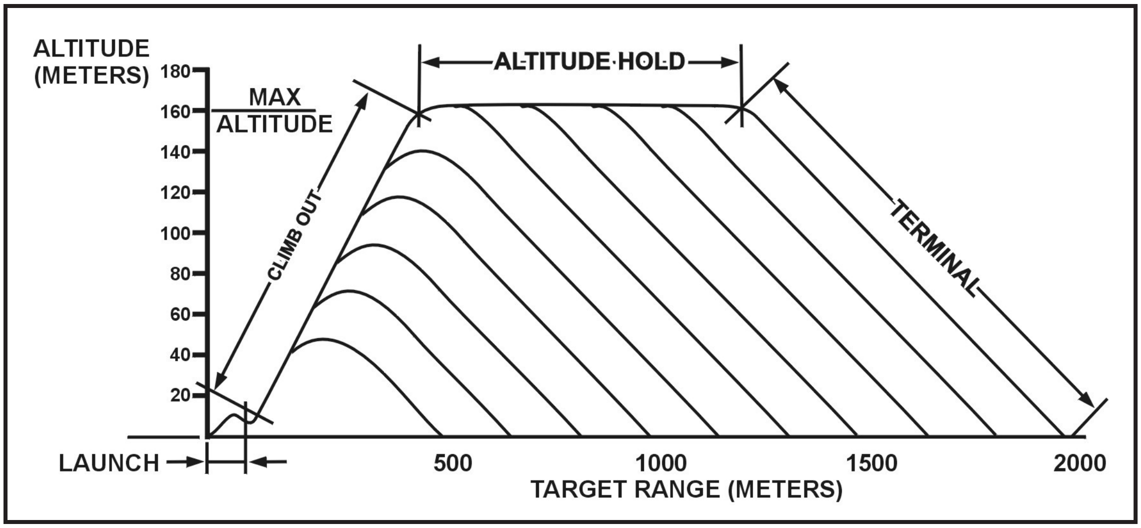

Figure 1-27. Top attack flight path.

DIRECT ATTACK MODE

1-54. The direct attack mode can be selected only after seeker cooldown and before lock-on. The gunner pushes the attack select (ATTK SEL) switch on the right handgrip to change attack modes. In the direct attack mode, the missile flies on a more direct path to the target. The missile impacts and detonates on the side (front, rear, or flank) of the target (Figure 1-28). The minimum engagement distance is 65 meters.

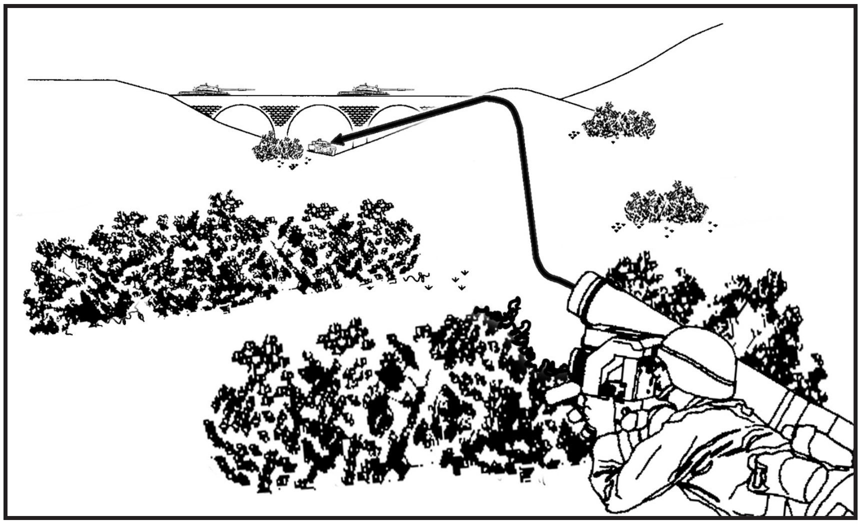

Figure 1-28. Direct attack mode.

1-55. The exact profile of the missile flight path shown in a general configuration in Figure 1-29 depends on the range to the target and is determined automatically by the missile's onboard software. With a 2,000-meter target, the missile reaches a height of about 60 meters above the battlefield. This path allows the missile to reach a target under a protective structure.

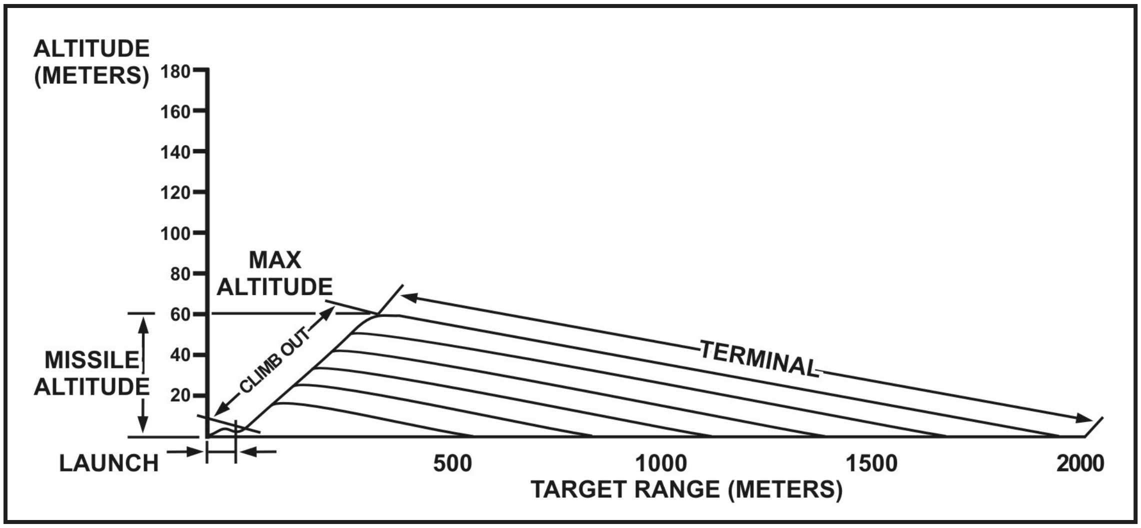

Figure 1-29. Direct attack flight path.

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Chapter 2

CONTROLS AND OPERATION

This chapter is an overview of the Javelin's controls and indicators, operation of the Javelin, and CLU display indicators.

CONTROLS AND INDICATORS

2-1. The Javelin controls allow the gunner to perform and monitor all operations. The controls are located on the handgrips except for the diopter adjust ring and the power switch.

DIOPTER ADJUST RING

2-2. The diopter adjust ring is located on the CLU eyepiece assembly (Figure 2-1). The gunner uses the diopter adjust ring to adjust the focus of the image. Any gunner with vision correctable to 20/20 can use the CLU to see an in-focus image without using glasses. The alignment mark is located on the eyepiece. Align the number that corresponds with the adjustment. This adjustment is constant on all CLUs.

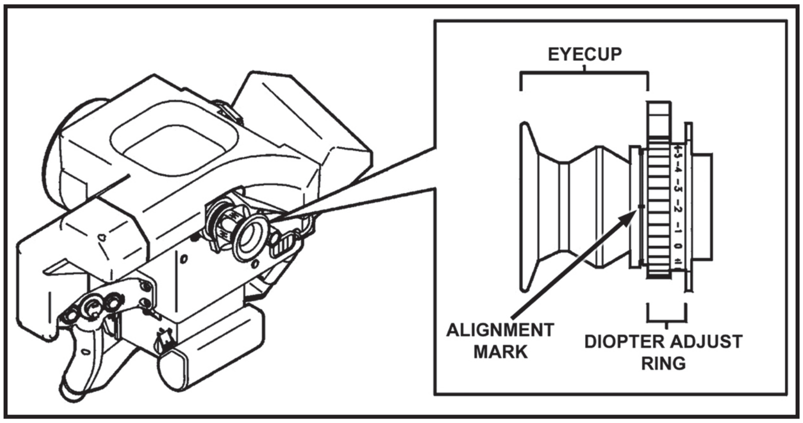


Figure 2-1. Diopter adjust ring.

POWER SWITCH

2-3. The power switch is a rotary switch located on the lower rear corner of the left-hand side of the CLU main housing (Figure 2-2). The power switch controls the Javelin's mode of operation and each position brings different components of the Javelin into operation. The power switch has four positions: OFF, DAY, NIGHT, and TEST.

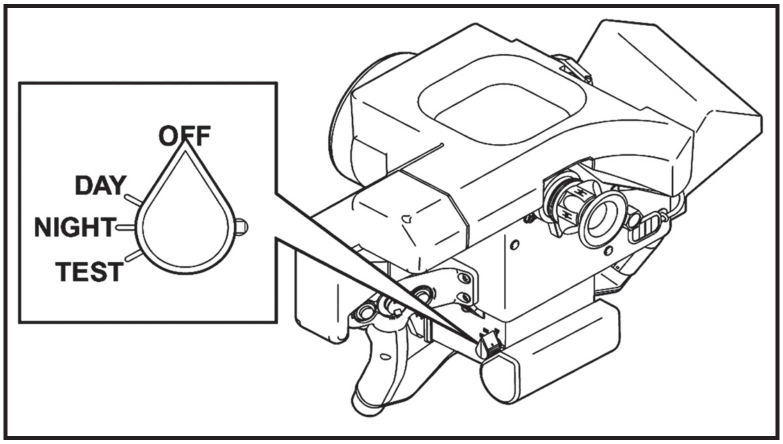


Figure 2-2. Power switch positions.

OFF Position

2-4. The Javelin is in the OFF mode when the power switch is in the OFF position. In this mode, no battery power is applied to the Javelin. The day field-of-view (FOV) can be used for surveillance and target detection, but the NVS cannot be used and the seeker cannot be activated. The missile cannot be launched.

DAY Position

2-5. The Javelin is in the DAY mode when the power switch is in the DAY position. In the day mode, power is applied to the CLU. In the day mode, there is a day FOV but no NVS.

NIGHT Position

2-6. The Javelin is in the NIGHT mode when the power switch is in the NIGHT position. This mode gives the gunner the full Javelin capability. Once the NVS is cooled down (about 2.5 to 3.5 minutes), the gunner selects WFOV, NFOV, and day FOV, which gives him the full missile capability.

TEST Position

2-7. The Javelin enters a built-in test (BIT) routine (Figure 2-3) when the power switch in the TEST position. The power switch is spring-loaded when in the test position. When the gunner moves the power switch to the TEST position, it then returns to the NIGHT position upon release.

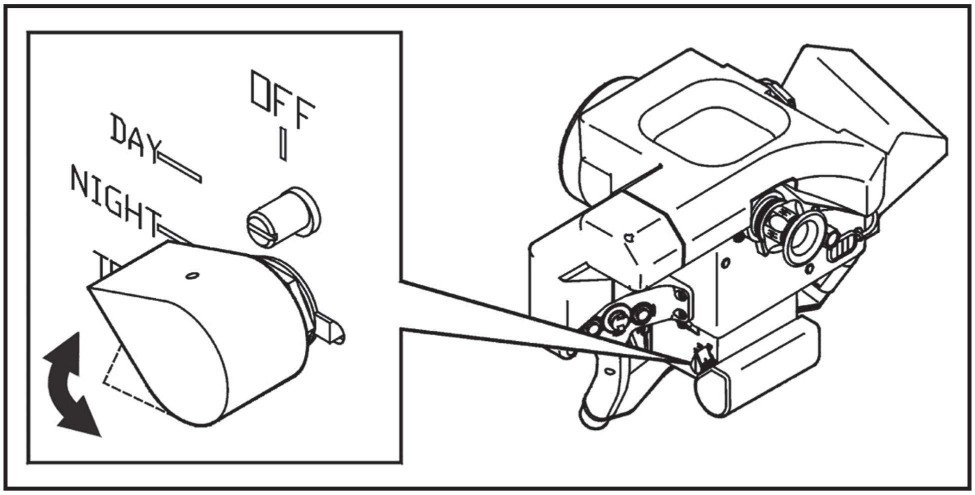


Figure 2-3. Power switch—TEST position.

Return to OFF

2-8. Before turning the power switch to OFF, the gunner must leave the power switch at DAY for at least two seconds to allow the flipper mirror time to move to the power switch to the DAY position.

LEFT HANDGRIP CONTROLS

2-9. The left handgrip (Figure 2-4) has the following controls: the filter select (FLTR) switch, the focus adjust (FOCUS) switch, the sight select (SGT SEL) switch, and the seeker trigger.

Function of Controls

2-10. These controls are used to assist the gunner in—

- Conducting surveillance.
- Detecting, classifying, and recognizing targets.
- Determining target range.
- Activating the missile seeker.
- Reacquiring the target in seeker FOV.
- Locking the missile seeker onto the target.
- Assessing battle damage.
- Activating system countermeasures.

Filter Select (FLTR) Switch

2-11. The FLTR switch (Figure 2-4) is the left switch on the left handgrip. This pushbutton switch is used to select the NVS filter; once initiated, the NVS filter prevents the enemy from detecting the CLU.

Focus Adjust (FOCUS) Switch

2-12. The FOCUS switch (Figure 2-4) is the center switch on the left handgrip. This switch is a self-centering toggle switch used to focus the image on the CLU display during NVS (WFOV or NFOV) operation.

Sight Select (SGT SEL) Switch

2-13. The SGT SEL switch (Figure 2-4) is the right switch on the left handgrip. This pushbutton switch is used to select day FOV, WFOV, NFOV, or seeker FOV.

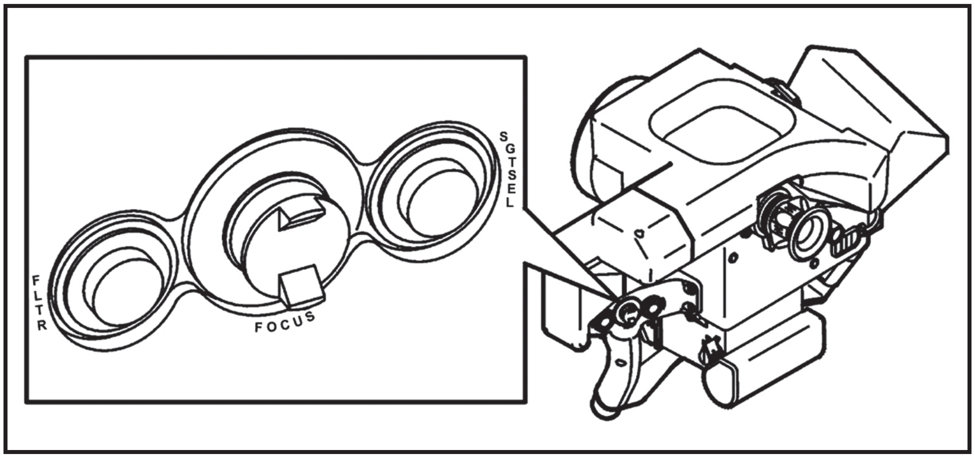


Figure 2-4. Left handgrip controls.

Seeker Trigger

2-14. The seeker trigger (Figure 2-5) is the trigger located on the fingergrip (front) side of the left handgrip. This trigger activates the seeker, locks the seeker onto the target, and enables the fire trigger. A trigger guard is provided to protect against accidental activation.

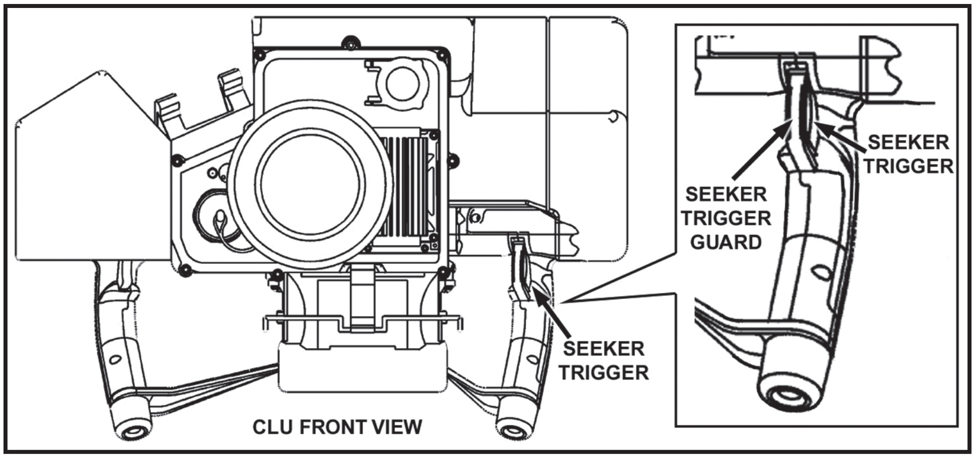


Figure 2-5. Left handgrip controls—seeker trigger.

RIGHT HANDGRIP CONTROLS

2-15. The right handgrip has the following controls: the attack select (ATTK SEL) switch, the gate adjust/contrast and brightness (GATE ADJ/CTRS & BRT) switch, and the fire trigger (Figure 2-6). These controls allow the gunner to—

- Change the attack mode, if necessary.
- Adjust the track gates so the seeker can lock onto the target.
- Adjust NVS contrast and brightness.
- Fire the missile.

Attack Select (ATTK SEL) Switch

2-16. The ATTK SEL switch (Figure 2-6) is the right switch on the two-switch console on the right handgrip. This pushbutton switch allows the gunner to toggle between the top attack and direct attack modes. The top attack mode is the default attack mode and is automatically selected when the seeker is activated. To change the mode of attack, the gunner must be in the seeker FOV.

Gate Adjust/Contrast and Brightness (GATE ADJ/CTRS & BRT) Switch

2-17. The GATE ADJ/CTRS & BRT switch (Figure 2-6) is the left switch of the two-switch console on the right handgrip. This self-centering switch moves up, down, left, and right. This switch serves two functions depending on whether the CLU display image is from the NVS or the seeker.

Night Vision Sight

2-18. When a CLU image is displayed using the NVS (WFOV or NFOV), the gunner uses the GATE ADJ/CTRS & BRT switch to adjust the contrast and brightness of the CLU display image. When the NVS first comes up, both the brightness and contrast are electronically adjusted so that they require minimal adjustment by the gunner.

Brightness

2-19. Brightness is adjusted by moving the GATE ADJ/CTRS & BRT switch vertically (up and down).

Contrast

2-20. Contrast is adjusted by moving the GATE ADJ/CTRS & BRT switch horizontally (left and right).

Seeker

2-21. When the CLU display shows the seeker (Figure 2-7) FOV, the GATE ADJ/CTRS & BRT switch is used to adjust the size of the track gates (the track gates are the four corners of the open-sided box shown in the seeker FOV).

UP and DOWN

2-22. UP moves the track gates apart vertically; DOWN moves the track gates together vertically.

LEFT and RIGHT

2-23. LEFT moves the track gates together horizontally; RIGHT moves the track gates apart horizontally.

Fire Trigger

2-24. The fire trigger (Figure 2-6) is on the front side of the right handgrip at the index finger level. When the gunner locks the missile onto the target, he squeezes and holds the seeker trigger, and then squeezes the fire trigger to launch the missile.

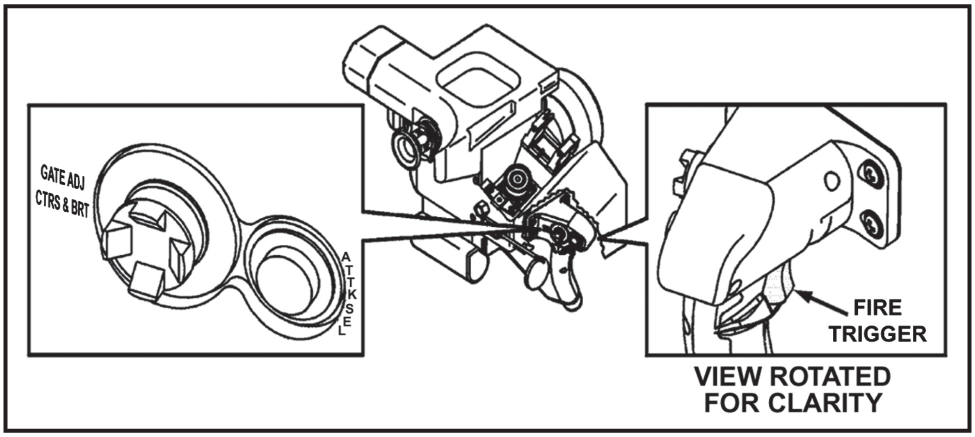


Figure 2-6. Right handgrip controls.

COMMAND LAUNCH UNIT STATUS INDICATORS

2-25. The CLU status (icon) indicators that appear around the CLU display are never on at the same time during normal operation. The gunner observes the status indicators by looking into the eyepiece. These indicators, coded in colors of green, amber, or red, identify Javelin operational modes, conditions, and malfunctions.

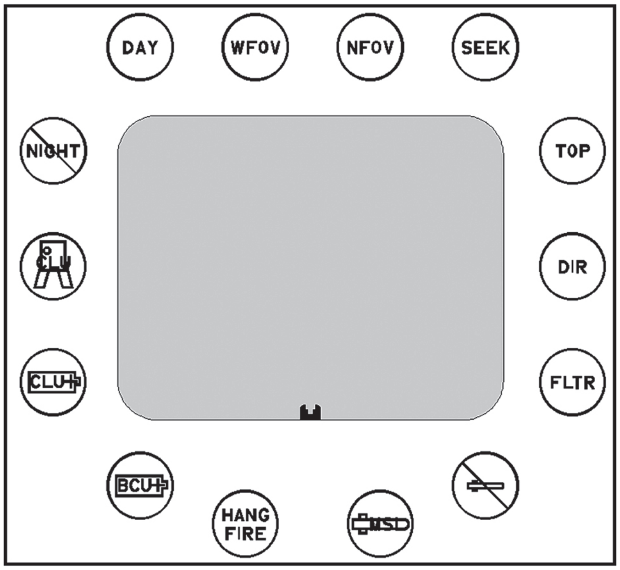


Figure 2-7. Command launch unit display indicators.

GREEN STATUS INDICATORS

2-26. Green indicators (Figure 2-8) signify that the monitored function is in satisfactory condition and that it is okay to proceed with normal operations.

Day (DAY) Indicator

2-27. The DAY indicator is located in the upper left corner of the CLU display. It lights up when the power switch is in the day or night position.

Wide Field-of-View (WFOV) Indicator

2-28. The WFOV indicator is located on the upper left side of the CLU display. A steady light indicates that the CLU is in WFOV, and a flashing light indicates that the NVS has reached a focus limit.

Narrow Field-of-View (NFOV) Indicator

2-29. The NFOV indicator is located on the upper right side of the CLU display. A steady light indicates that the CLU is in NFOV, and a flashing light indicates that the NVS has reached a focus limit.

Seeker (SEEK) Indicator

2-30. The SEEK indicator is located in the upper right corner of the CLU display. It lights up within 3 seconds after squeezing the seeker trigger.

Top Attack (TOP) Indicator

2-31. The TOP indicator is located on the upper right side of the CLU display. It lights up when the missile is in the top attack mode.

Direct Attack (DIR) Indicator

2-32. The DIR indicator is located on the center right side of the CLU display. It lights up when the missile is in the direct attack mode.

Filter (FLTR) Indicator

2-33. The FLTR indicator is located on the bottom right side of the status display. It lights up when the NVS filter is selected.

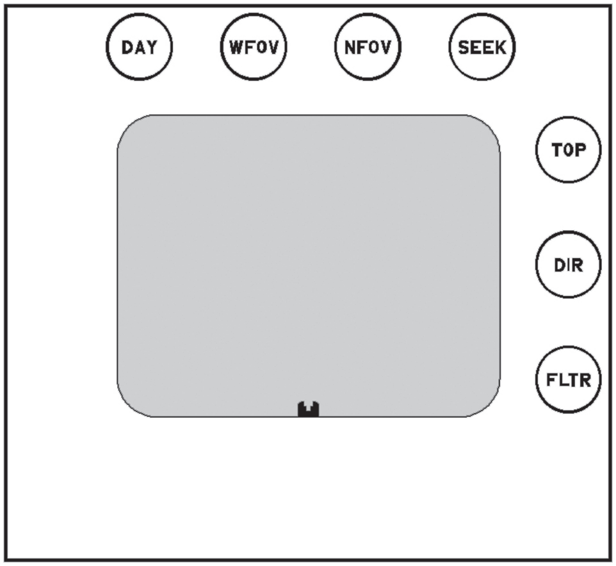


Figure 2-8. Status indicators—green.

AMBER STATUS INDICATORS

2-34. Amber status indicators (Figure 2-9) become illuminated when a marginal condition exists. It also alerts the gunner to situations where caution, a recheck, or an unexpected delay is necessary.

NVS NOT COOL Indicator

2-35. The NVS NOT COOL indicator is located on the upper left side of the CLU display. It lights up when the CLU is in the night mode, but the DDC has not cooled to its operating temperature. The indicator goes out when the NVS is cooled to its operating temperature. If the DDC warms up again, this indicator comes back on.

MISSILE NOT READY Indicator

2-36. The MISSILE NOT READY indicator is located on the bottom right side of the CLU display. A steady light indicates that the missile flight information is not downloaded from the CLU, missile BIT is not complete, or seeker is not cooled; a flashing light indicates that the missile electronics are close to overheating. The missile shuts down within 30 seconds after the flashing starts.

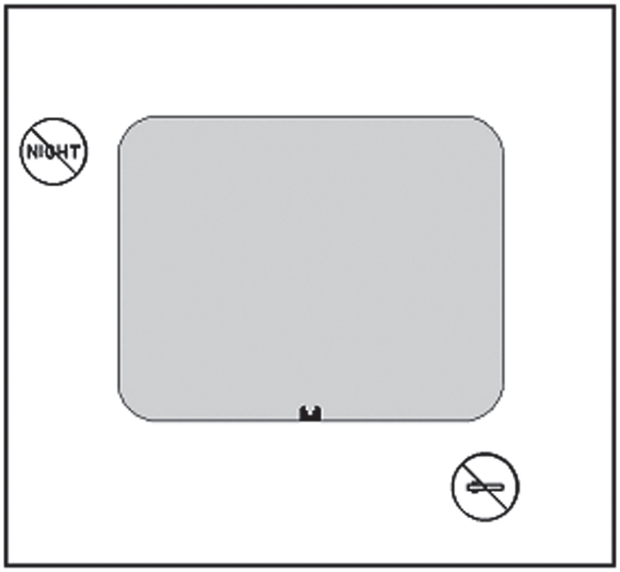


Figure 2-9. Status indicators—amber.

RED STATUS INDICATORS

2-37. There are two types of red indicators (Figure 2-10). A flashing red indicator warns the gunner of an emergency condition where action must be taken. A solid red indicator tells the gunner that the Javelin is inoperative and a successful missile launch is not possible until corrective action is taken.

MISSILE BIT FAILURE Indicator

2-38. The MISSILE BIT FAILURE indicator is located on the bottom right side of the CLU display. A steady light indicates that the missile BIT has detected a failure in the missile, and a flashing light indicates a misfire when the gunner squeezes the fire trigger and the missile does not launch.

HANGFIRE Indicator

2-39. The HANGFIRE indicator is located on the bottom left side of the CLU display. The HANGFIRE indicator flashes to indicate a missile hangfire when the gunner squeezes the fire trigger and the missile does not launch.

BCU Indicator

2-40. The BCU indicator is located on the bottom left side of the CLU display. After seeker activation, the BCU indicator flashes to indicate that the BCU has about 30 seconds of operating time remaining, and it illuminates solid red when the BCU is spent.

CLU BATTERY Indicator

2-41. The CLU BATTERY indicator is located on the bottom left side of the CLU display. The indicator lights up to indicate that the CLU battery has about 5 minutes of operating time remaining.

CLU BIT FAILURE Indicator

2-42. The CLU BIT FAILURE indicator is located on the center left side of the CLU display. The CLU BIT FAILURE light comes ON when the CLU has failed an automatic BIT.

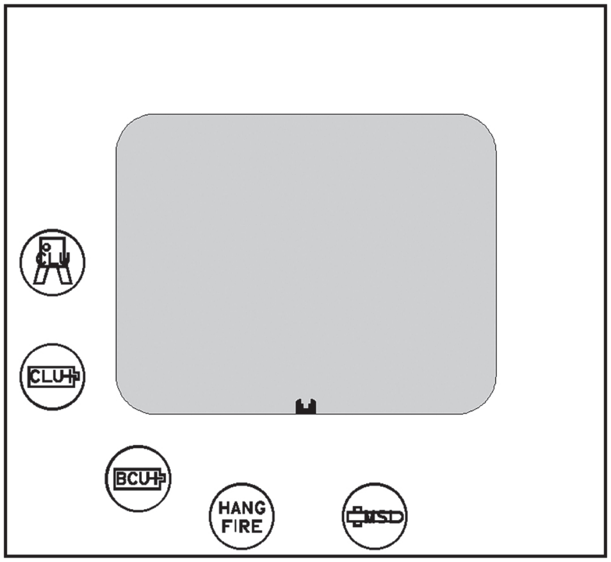


Figure 2-10. Status indicators—red.

COMMAND LAUNCH UNIT DISPLAY INDICATORS

2-43. The CLU display indicators include stadia, reticles, track gates, and crosshairs.

STADIA

2-44. Stadia are seen in all CLU fields of view. They change their appearance, size and location according to the FOV selected. The CLU has three different stadia for each of the three CLU fields of view. The day FOV stadia are seen in all FOVs, but are used only in day FOV. The WFOV and NFOV stadia are present only in their respective fields of view.

Day Field-of-View Stadia

2-45. Day FOV stadia (Figure 2-11) are attached permanently to and appear at the bottom center of the CLU display.

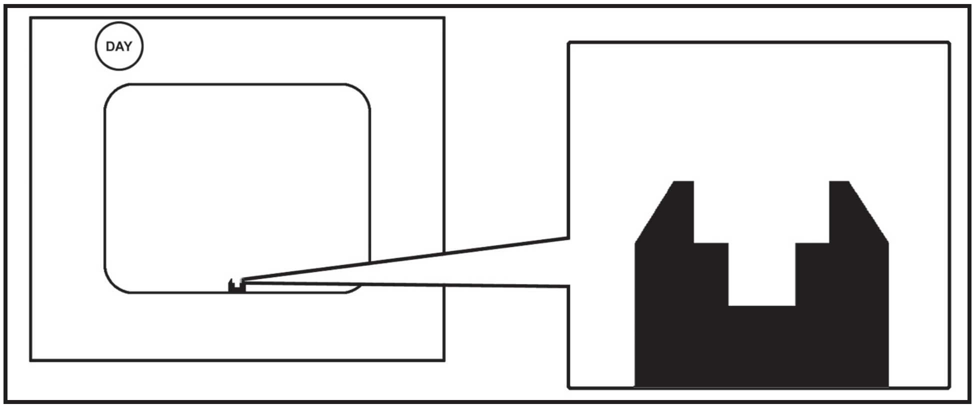


Figure 2-11. Day field-of-view stadia.

Wide Field-of-View Stadia

2-46. WFOV stadia consist of two vertical lines centered at the top of the CLU display (Figure 2-12A). The WFOV stadia are visible only in WFOV.

Narrow Field-of-View Stadia

2-47. NFOV stadia also consist of two vertical lines centered at the top of the CLU display (Figure 2-12B). The NFOV stadia are visible only in NFOV.

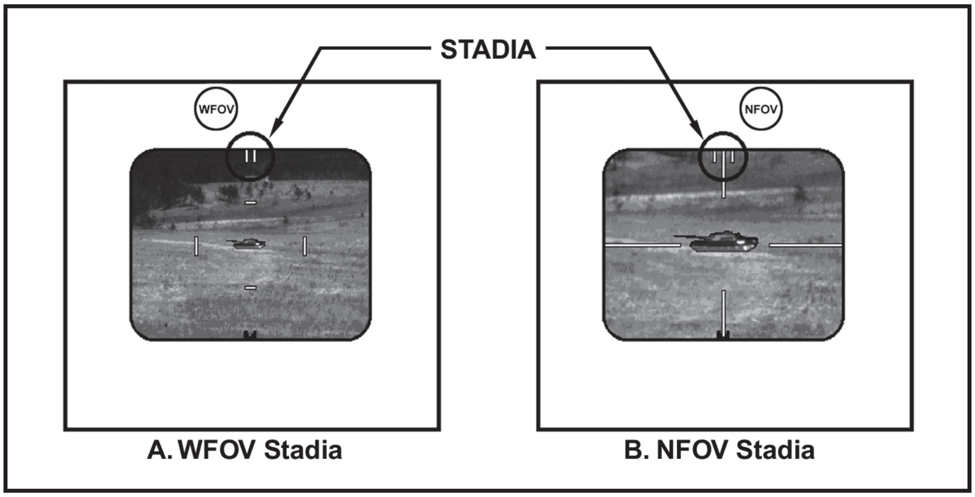


Figure 2-12. Night vision sight stadia comparisons.

RETICLES

2-48. In WFOV and NFOV, lines appear on the CLU display, and the configuration of lines in the reticles change from WFOV to NFOV, which allows the gunner to identify the FOV just by looking at the display (Figure 2-13).

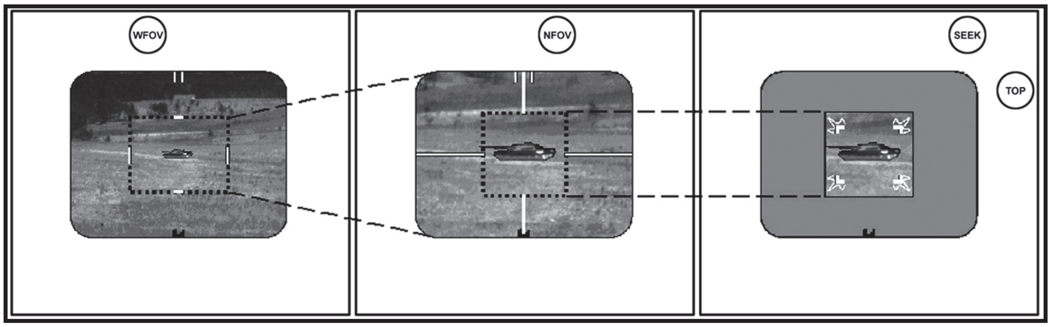


Figure 2-13. Reticle area versus field-of-view change.

TRACK GATES

2-49. The track gates (Figure 2-14) are used by the gunner to lock the seeker on target. The gunner activates the seeker and the track gates appear and flash in the CLU display. The track gates are a visual indication the seeker is active but not locked on the target.

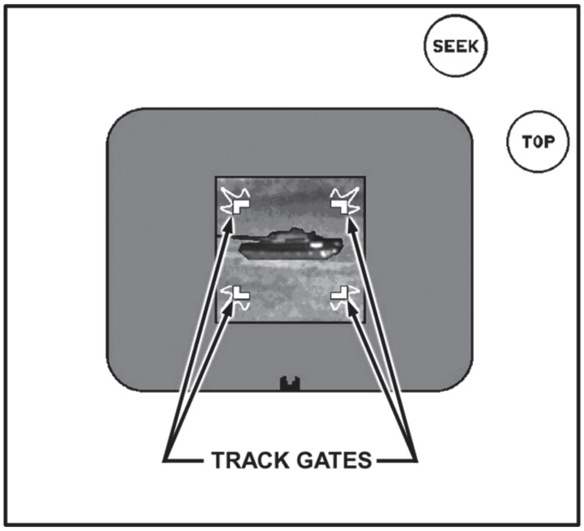


Figure 2-14. Track gates.

CROSSHAIRS

2-50. The gunner uses the crosshairs (Figure 2-15) to designate the center of mass, which the seeker locks on. The crosshairs first appear and are flashing when the gunner squeezes and holds the seeker trigger. After the seeker locks on the target, the track gates and crosshairs become solid.

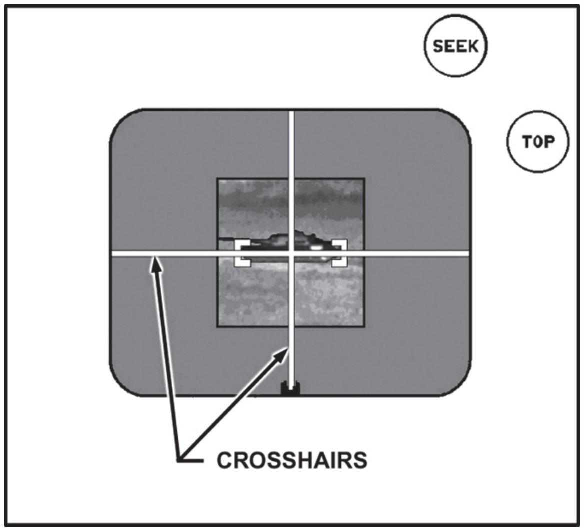


Figure 2-15. Crosshairs.

PREPARATION FOR FIRING

2-51. During preparation, the gunner performs a BIT, inspects the round, and prepares to fire. There are seven steps in preparing the Javelin for firing:

(1) Prepare the Javelin components.
  - Place the round on the ground with the flat sides of the end caps down.
  - Place the carry bag on the ground on the left side of the round.

(2) Remove the CLU from the carry bag.
  - Open the carry bag.
  - Grasp the CLU by the handgrip and remove it from the carry bag.

(3) Install the CLU battery (Figure 2-16).

NOTE: The battery compartment is located on the bottom of the CLU.

- Turn the CLU 180 degrees to reveal the battery compartment.
- The battery compartment cover is held in place by a wire bail. Detach and move the wire bail cover out of the way.
- The compartment is equipped with a battery connector. This connector mates with the corresponding connector on the battery. Align the two connectors and attach.
- Replace the battery compartment cover, and reattach the wire bail.

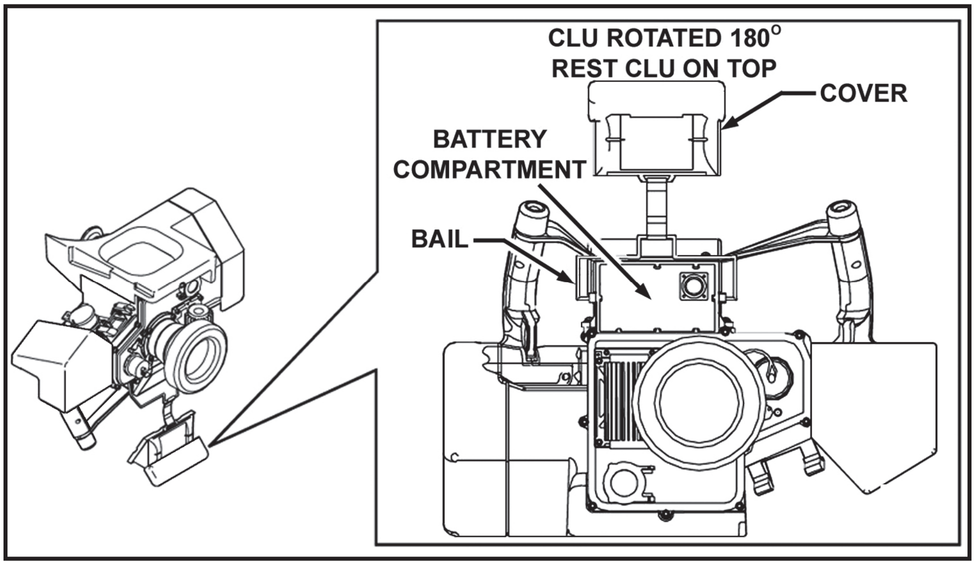


Figure 2-16. Battery compartment.

(4) Connect the CLU to the round (Figure 2-17).

- Kneel on the left side of the round, at the forward end, facing forward.
- Remove the protective cover from the CLU and round interface connectors. Pull on the lanyard tab to secure the protective cover against the side of the round and CLU. Position the protective covers so that they do not interfere when the CLU and round are connected.
- Grasp the handgrips, and lift the CLU into position over the CLU interface connector. Keep the eyecup pointed toward the aft end of the round (Figure 2-18).
- Place the round interface bracket in the round hooks.

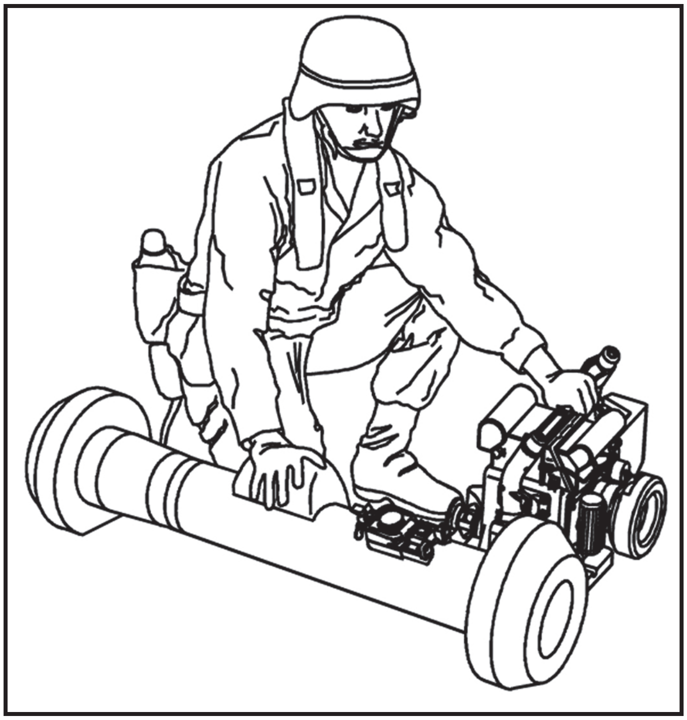


Figure 2-17. Connect the round to the command launch unit.

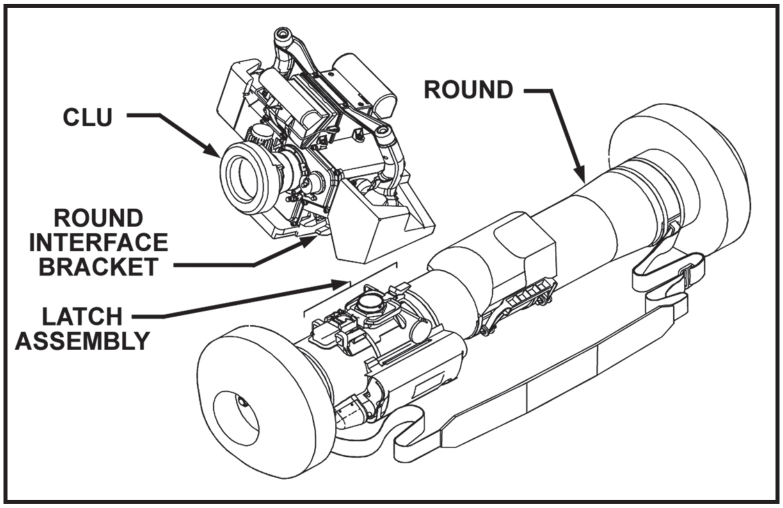


Figure 2-18. Connect the command launch unit to the round.

- Slide the CLU toward the latch release and press down on the CLU to engage the CLU and the round interface connectors. When the latch release snaps into place, the CLU and round are connected (Figure 2-19).
- Ensure CLU and round connectivity by rocking the CLU from side to side before attempting to pick up the Javelin.

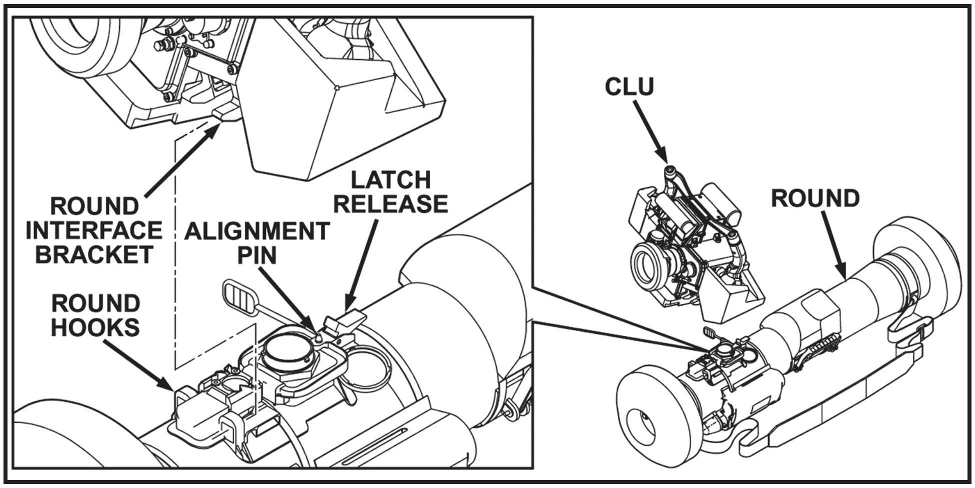


Figure 2-19. Connect the command launch unit to the round.

(5) Turn the power switch from the OFF position to the NIGHT position (Figure 2-20).

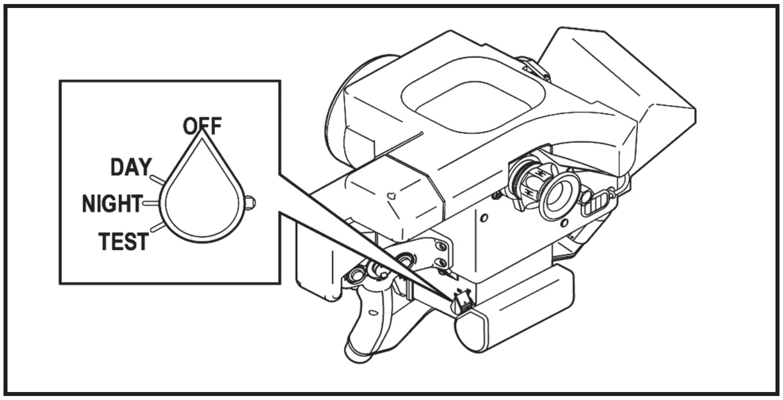


Figure 2-20. Power switch.

(6) Remove the forward end cap (Figure 2-21).

- Remove the locking pin from the forward end cap by pulling straight up on the wire rope.
- Using the left hand, turn the forward end cap latch release counterclockwise.
- Grasp the handgrip with the right hand and lift the front end of the Javelin enough to raise the forward end cap off the ground.
- Slide the forward end cap off the round. If the forward end cap does not come off press the manual release button until the hissing stops. Set the open end of the round on the forward end cap to prevent dirt and debris from obstructing the seeker. When the forward end cap is removed, the gunner must use extreme caution not to damage the seeker or allow foreign material to come in contact with the seeker.

CAUTION

With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure no foreign material comes in contact with the seeker.

- Inspect the open end of the round for dirt and foreign material. Remove any dirt or foreign material that is present.

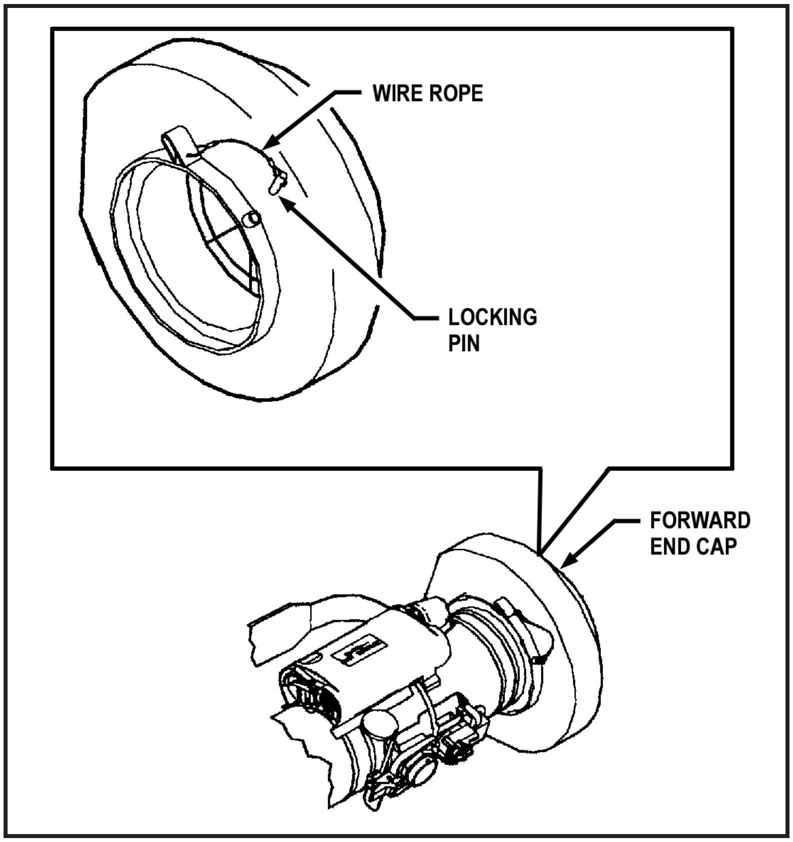


Figure 2-21. Remove the forward end cap.

(7) Open the lens covers. Ensure the daysight and NVS lens covers are completely open.

FIRING POSITIONS

2-52. Firing positions for the Javelin include: sitting (bent knees or legs crossed), the kneeling (using one knee or both knees), standing supported, and the prone supported.

SITTING POSITION

2-53. To fire the Javelin from the sitting position—

(1) Sit on the left side of the Javelin facing the direction of fire.
(2) Check the backblast area.
(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round near the shoulder pad.
(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.
(5) Assume a comfortable sitting position with legs crossed (Figure 2-22A) or knees bent (Figure 2-23B).

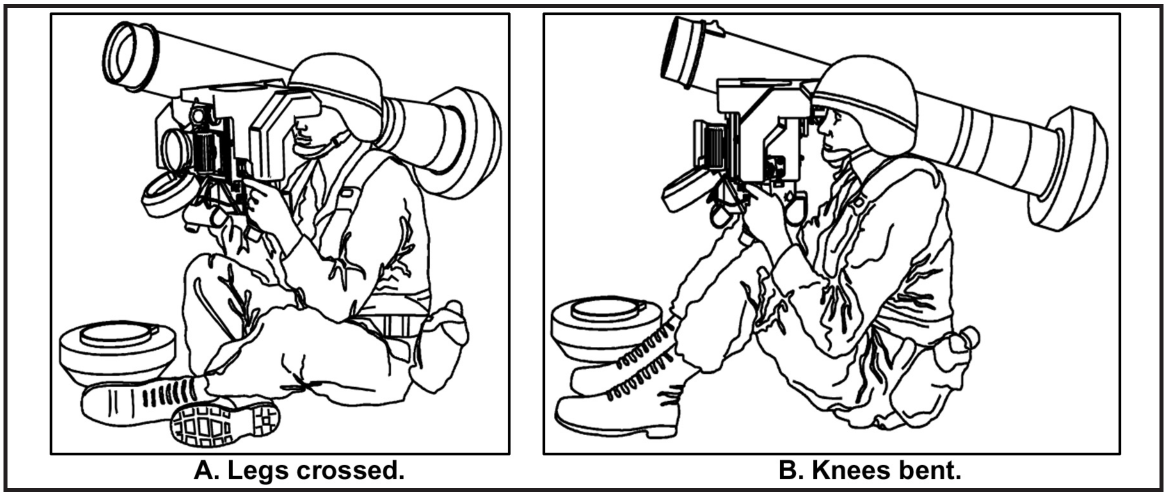

A. Legs crossed. B. Knees bent.

Figure 2-22. Javelin sitting firing positions.

(6) Adjust the body while holding the CLU.

(7) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched.

(8) After assuming the sitting position, ensure the forward end cap is on the ground, in front of and slightly to the right of the right leg or foot. The gunner is prepared.

KNEELING POSITION

2-54. To fire the Javelin from the kneeling position—

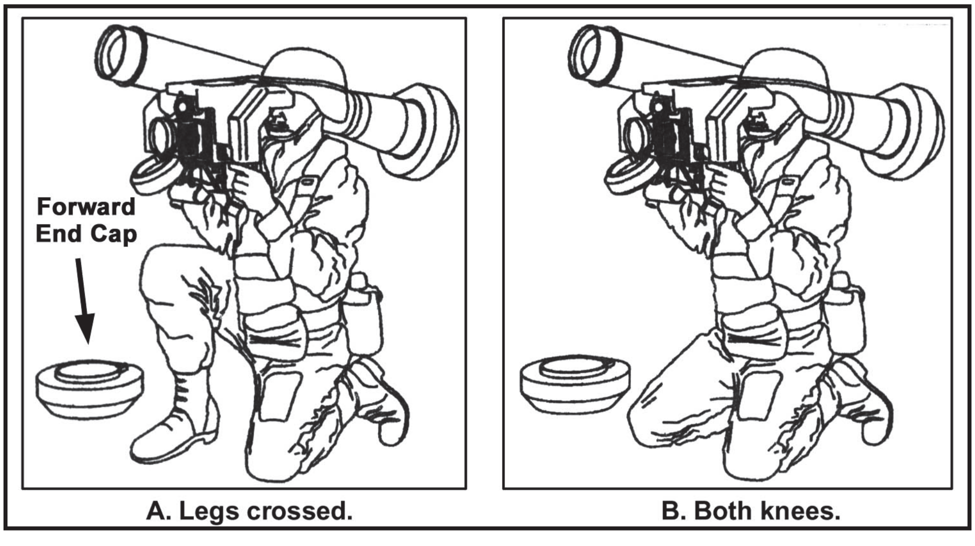
(1) Kneel on the left side of the Javelin facing the direction of fire.

(2) Check the backblast area.

(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round near the shoulder pad.

(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.

(5) Kneel in a comfortable position with one knee (Figure 2-23A) or both knees on the ground (Figure 2-23B).



A. Legs crossed. B. Both knees.

Figure 2-23. Javelin kneeling firing position.

(6) Hold the CLU by the right handgrip and adjust the body until comfortable with the Javelin.

(7) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched (Figure 2-24).

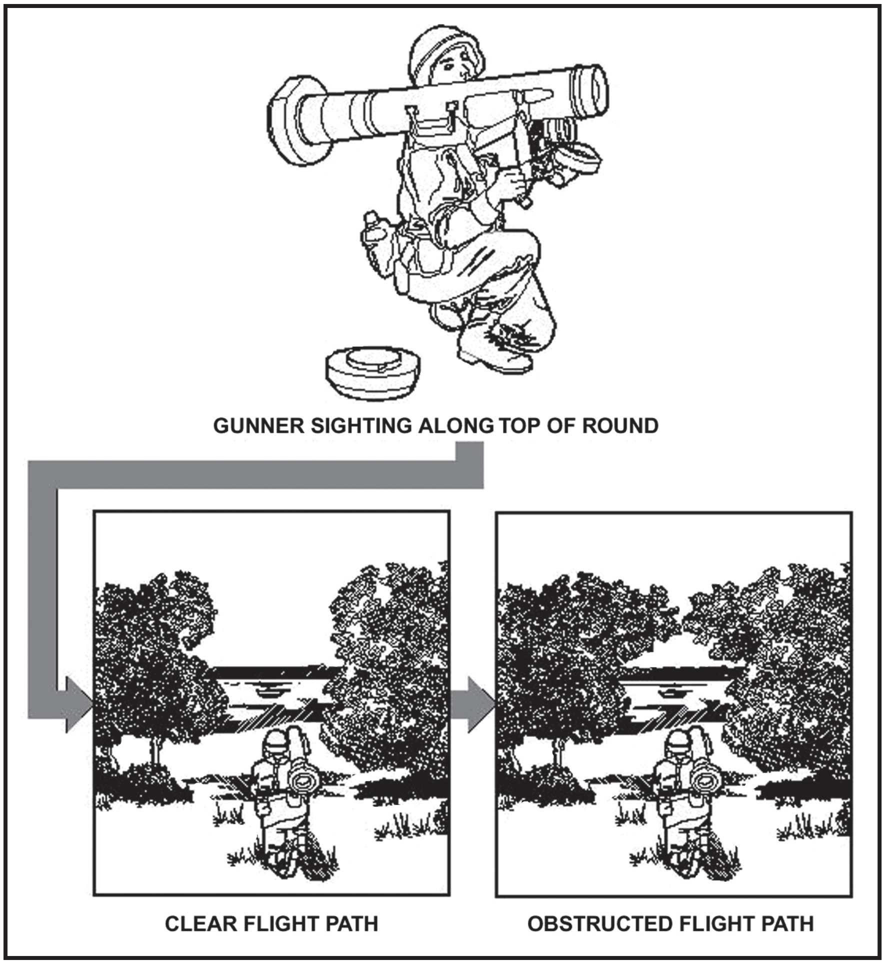


Figure 2-24. Gunner sights along the top of the round for obstructions.

(8) After assuming the kneeling position, ensure the forward end cap is on the ground, in front of and slightly to the right of the right leg or foot.

(9) The gunner is now prepared to fire the Javelin.

STANDING SUPPORTED POSITION

2-55. To fire the Javelin from the standing supported position—

(1) Stand on the left side of the Javelin facing the direction of fire. Take up a kneeling position with the right knee on the ground.

(2) Check the backblast area.

(3) Grasp the left handgrip of the CLU with the left hand. Place the right hand under the round nearest the shoulder pad.

(4) Lift the Javelin in a single, smooth motion and position the shoulder pad on the right shoulder.

(5) From this one knee position, stand up keeping the back straight and the weight balanced. The gunner keeps his balance by standing with the legs spread a comfortable distance apart (Figure 2-25).

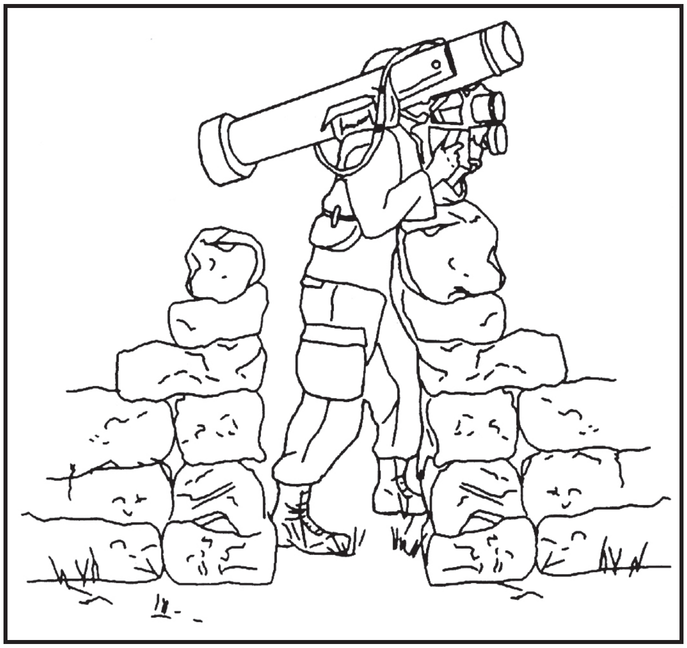


Figure 2-25. Standing supported firing position.

(6) Move the right hand to the right handgrip of the CLU. Place the elbows on the edge or rim of the fighting position or other steady feature to provide support.

(7) Adjust the body until the Javelin feels comfortable.

(8) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched.

(9) After assuming a firing position, ensure that the forward end cap is on the ground and slightly to the right of the right leg or foot. The gunner is now prepared to fire the Javelin.

PRONE SUPPORTED POSITION

2-56. To fire the Javelin from the prone supported position—

(1) Set the round on the ground with the flat sides of the end caps face down. The CLU interface connector and latch assembly should be face up.

(2) Ensure the round points toward the target area.

(3) Place the carry bag (with CLU) on the left side of the round by the forward end.

(4) Lay on the left side along the left side of the round next to the carry bag (Figure 2-26). Maintain a low profile to limit observation of movement.

(5) Remove the CLU from the carry bag.

(6) Turn the power switch to the NIGHT position.

(7) Connect the CLU to the round.

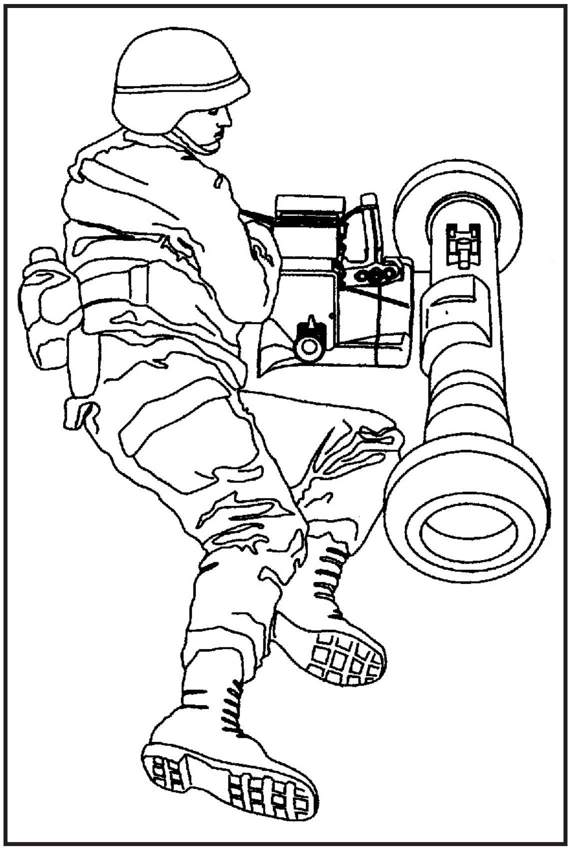


Figure 2-26. Preparing to connect the command launch unit.

(8) Remove the forward end cap (Figure 2-27).

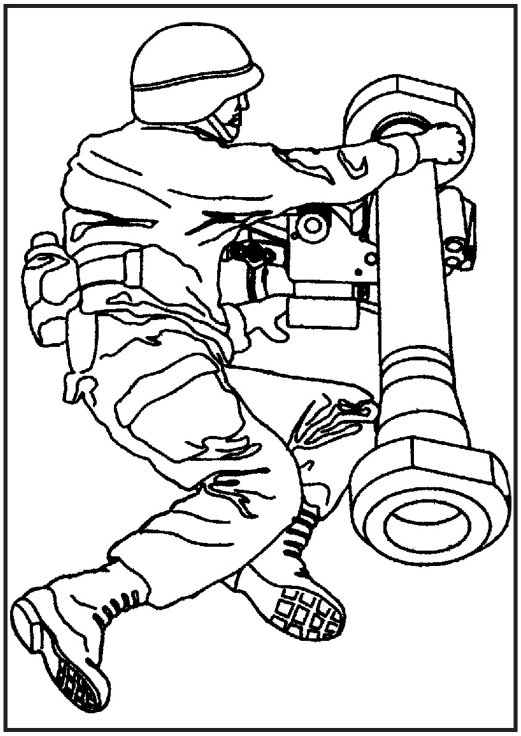


Figure 2-27. Remove the forward end cap.

CAUTION

With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure no foreign material comes in contact with the seeker.

(9) Place the forward end cap directly under the open end of the Javelin.

(10) Open the NVS and daysight lens covers.

(11) Check the backblast area. Ensure no personnel are located in the primary danger zone or caution areas.

(12) Position the body so it is parallel with the Javelin with the left hand tightly on the left handgrip. Placing the left hand on left handgrip helps guide the Javelin and maintain control. The right shoulder should be just behind the shoulder pad to balance the weight.

(13) The gunner tilts his body and the Javelin to the left side and, at the same time, reaches out with the right hand to secure the forward end cap (Figure 2-28).

NOTE: The forward end cap supports the Javelin's weight when in the prone position.

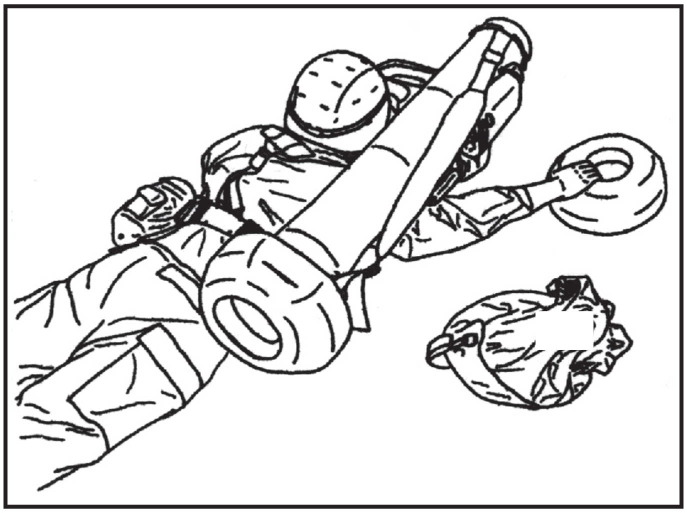


Figure 2-28. Reaching for forward end cap.

(14) Grasp the forward end cap; hold it with the inside of the forward end cap facing toward the CLU and the flat side of the forward end cap facing up.

(15) Place the flat side of the forward end cap against the round shoulder pad (Figure 2-29).

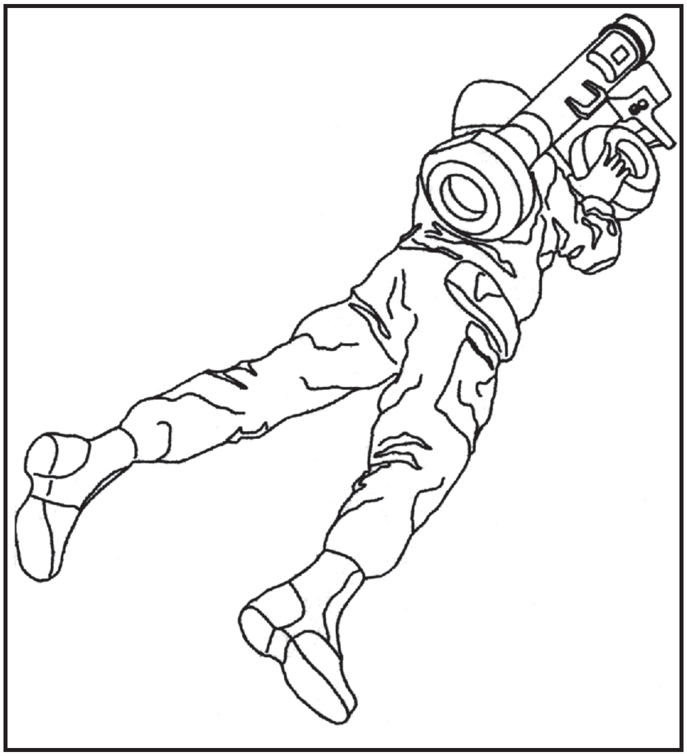


Figure 2-29. Placing end cap.

(16) Slide the forward end cap forward until the forward end cap locking ring contacts the shock absorber on the battery compartment. This wedges the forward end cap into position (Figure 2-30).

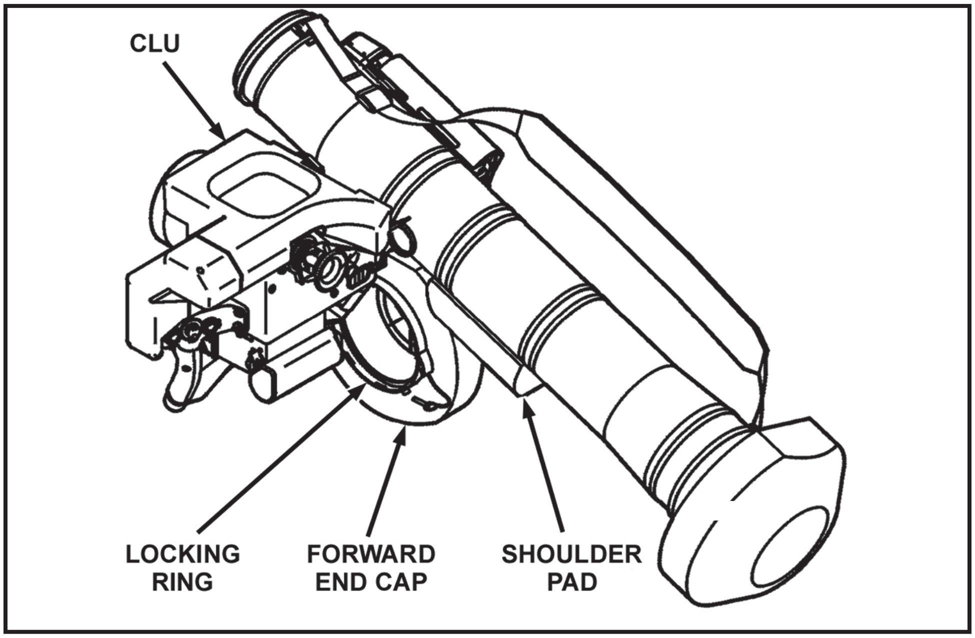


Figure 2-30. Placement of forward end cap in prone position.

(17) Slowly lower the Javelin until it rests on the forward end cap. Slide the body forward so the right shoulder is against the forward end cap.

PRONE SUPPORTED POSITION CHECK

2-57. To check the prone supported position—

(1) Ensure reaching the right handgrip switches is possible and easy to operate.

(2) Ensure the Javelin is supported by the forward end cap and is not resting on the shoulder (Figure 2-31).

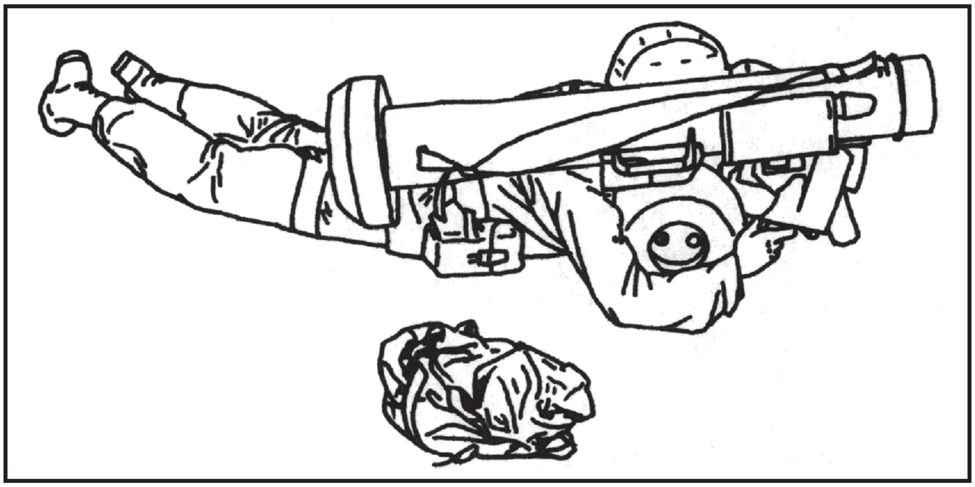


Figure 2-31. Prone supported firing position.

(3) Pull the Javelin tightly into the body until the forward end cap fits against the right shoulder.

WARNINGS

1.Injury will occur if the body is extended into the backblast area. If injured, seek medical help immediately.

2.Keep body at a 30-degree angle away from the round when firing from the prone position.

(4) Place the body at a 30-degree angle to the length of the round (intended direction of fire) to prevent the legs from extending into the backblast area (Figure 2-32).

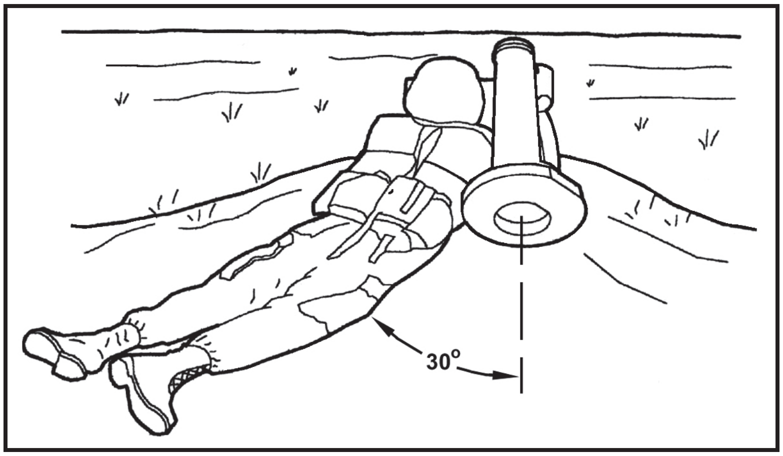


Figure 2-32. Correct prone body position.

(5) Check the overhead flight path between the target and the firing position by sighting along the top of the round. The missile must have a clear flight path once launched.

(6) The gunner is now prepared to fire the Javelin.

RESTORE TO CARRYING CONFIGURATION

2-58. To restore the Javelin to the carrying configuration, the gunner turns the power switch to the OFF position, places the Javelin on the ground, closes the lens cover, replaces the forward end cap, and disconnects the CLU from the round.

CAUTION

With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure that no foreign material comes in contact with the seeker. Ensure that the LTA is clear of debris before reinstalling the forward end cap.

2-59. If the seeker has been activated, the gunner replaces the BCU by installing a new one, and places the CLU in the carry bag.

TURN THE POWER SWITCH TO OFF

2-60. The gunner turns the power switch to the DAY position and waits for the flipper mirror to switch to the day sight position (about 2 seconds), then he turns the power switch to OFF (Figure 2-33).

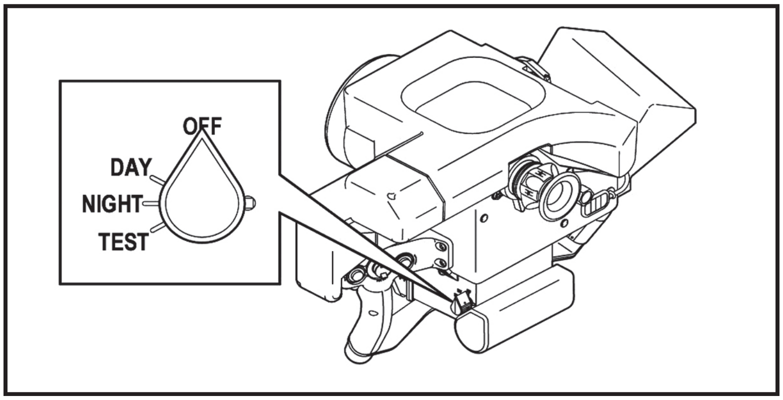


Figure 2-33. Power switch OFF position.

PLACE THE JAVELIN ON THE GROUND

2-61. When placing the Javelin on the ground, rotate the Javelin so the round rests on the ground and the handgrips of the CLU are pointing skyward.

CAUTION

With the forward end cap removed, the seeker is exposed. Use extreme caution when tipping the Javelin forward to ensure that no foreign material comes in contact with the seeker.

CLOSE THE COMMAND LAUNCH UNIT LENS COVERS

2-62. Close the DAY sight and NVS lens cover. Ensure the lens covers are firmly seated in place.

REPLACE THE FORWARD END CAP

2-63. To replace the forward end cap—

(1) Grasp the handgrip with the right hand and lift the forward end of the round off the top of the forward end cap (Figure 2-34).

(2) Check to ensure the forward end cap latch is in the open position.

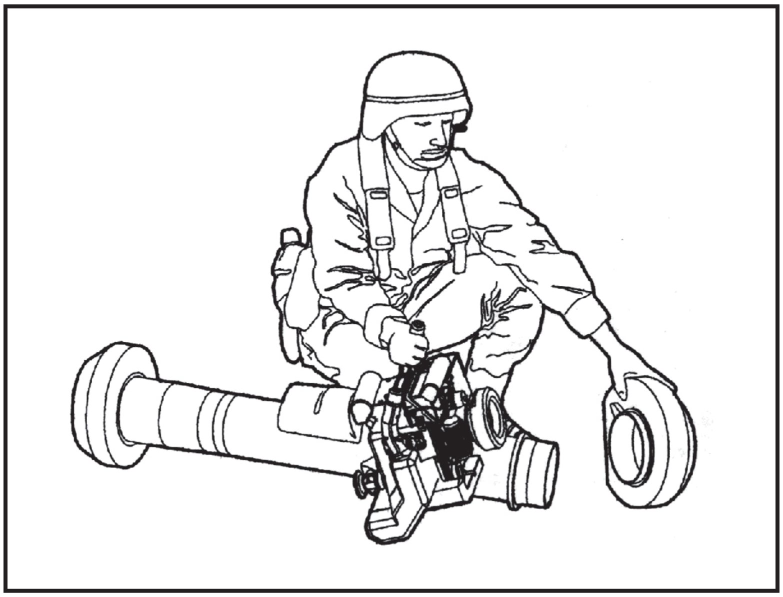


Figure 2-34. Replace forward end cap.

(3) Align the forward end cap latch handle with the BCU pylon.

(4) Slide the forward end cap onto the round and turn the latch clockwise to engage the locks.

(5) Reinstall the locking pin in the hole in the forward end cap (Figure 2-35).

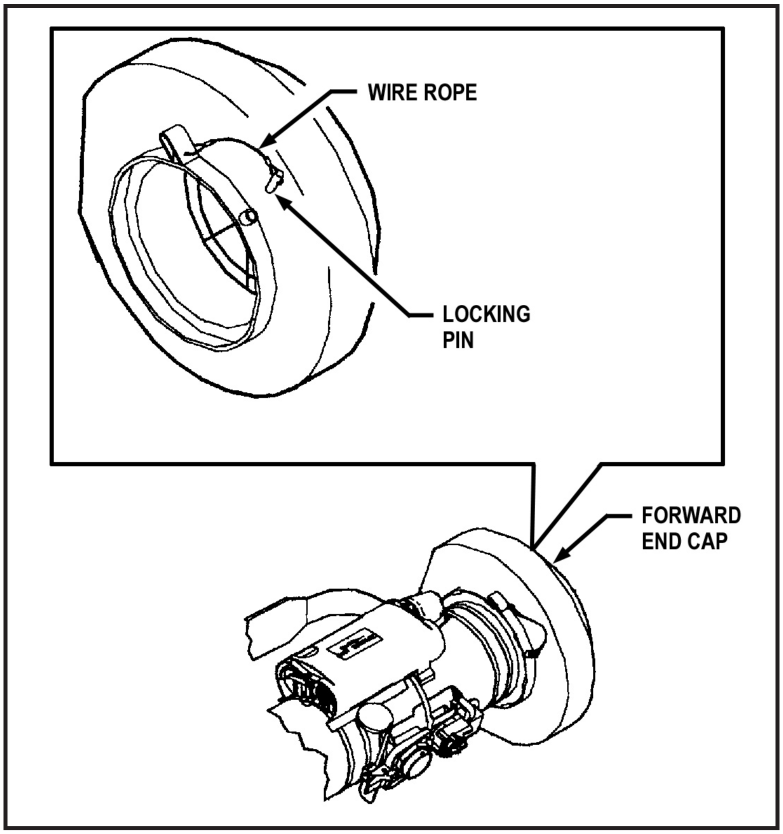


Figure 2-35. Forward end cap locking pin.

DISCONNECT THE COMMAND LAUNCH UNIT FROM THE ROUND

2-64. To disconnect the CLU from the round—

(1) Depress the latch release on the round (Figure 2-36).

(2) Using the handgrip, lift up and rotate the CLU toward the forward end cap. The CLU rotates away from the round interface connector and the round hooks.

(3) Reinstall the connector covers on the interface connectors on the CLU and on the round. If the seeker was activated, replace the BCU.

(4) Place the CLU in the CLU carry bag with the handgrips up and the eyepiece toward the back of the carry bag.

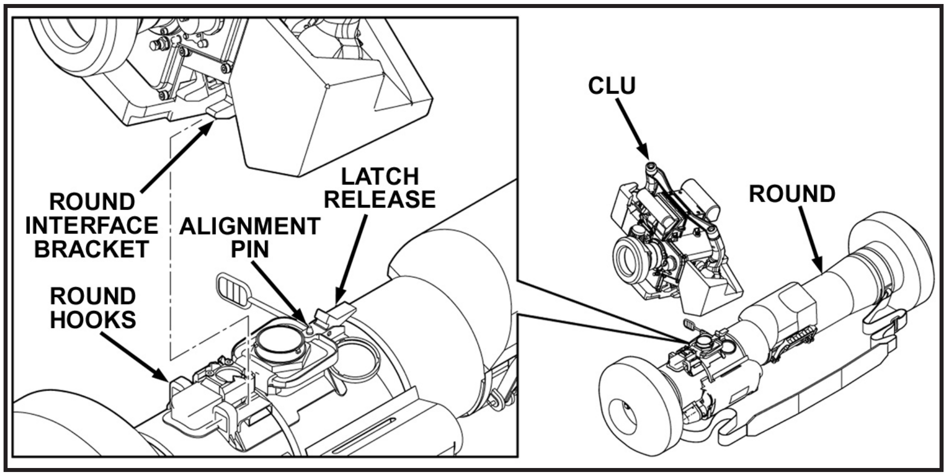

CLU
ROUND
ROUND INTERFACE BRACKET
LATCH RELEASE
ALIGNMENT PIN
ROUND HOOKS

Figure 2-36. Disconnect the command launch unit from the round.

REPLACE THE BATTERY COOLANT UNIT

2-65. If the seeker has been activated, replace the BCU. To replace the BCU—

(1) Remove the expended BCU.

(2) Kneel on the left side of the round and position the Javelin on the ground so the handgrips point up.

(3) If BCU has solid heat shield (Figure 2-37)—

- Lift BCU latch with the thumb.
- Slide the BCU to the rear to release it from the guide pins.

(4) If BCU has grilled heat shield (Figure 2-38)—

- Push down on the BCU latch with the thumb.
- Grasp the BCU with the opposite hand and slide it to rear to release it from the guide pins.

INSTALL A NEW BATTERY COOLANT UNIT

2-66. To install a new BCU—

(1) Remove the shipping plug that protects the internal gas bottle.

(2) Inspect BCU status indicator to ensure the replacement BCU is operational.

(3) Place BCU on the round's guide pins with the catch to the rear of round, slide the BCU onto the guide pins. Ensure the BCU snaps into place.

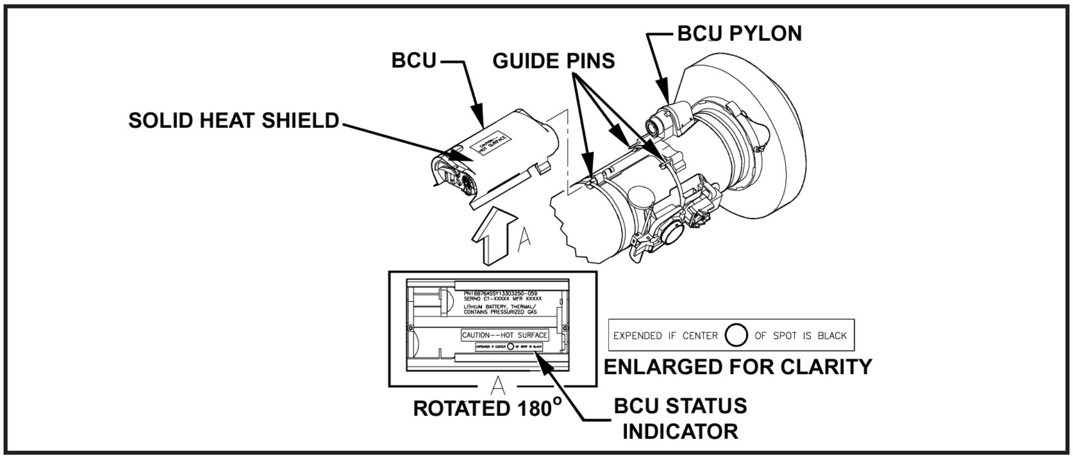

BCU PYLON
BCU
GUIDE PINS
SOLID HEAT SHIELD
A
PN18876ASSY13303250-059
SERNO CT-XXXXX MFR XXXXX
LITHIUM BATTERY, THERMAL/
CONTAINS PRESSURIZED GAS
CAUTION--HOT SURFACE
EXPENDED IF CENTER OF SPOT IS BLACK
A
ROTATED 180°
EXPENDED IF CENTER ○ OF SPOT IS BLACK
ENLARGED FOR CLARITY
BCU STATUS INDICATOR

Figure 2-37. Old battery coolant unit.

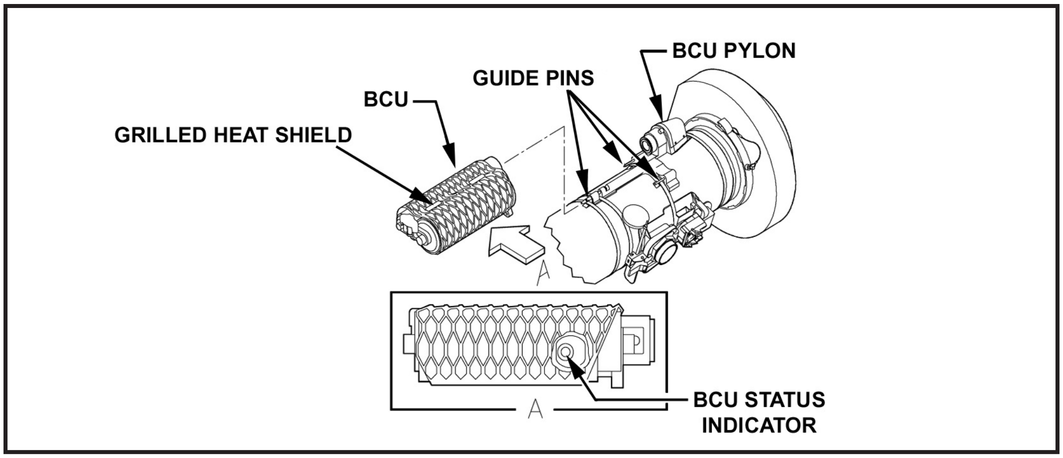


Figure 2-38. New battery coolant unit.

CARRYING TECHNIQUES

2-67. Three techniques are used for carrying the Javelin. The choice is based on mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC); the situation; and the distance to be traveled.

TACTICAL CARRY

2-68. This technique is used when moving into position, between positions, and when enemy contact is likely (Figure 2-39).

(1) The CLU and round are connected. Both end caps are secured to the round, and the NVS and day sight lens covers are closed to prevent damage.

(2) The Javelin is carried on the gunner's right shoulder, balanced on the shoulder pad. The left hand holds the left handgrip, and the right hand is on top of the round.

(3) The gunner's assigned weapon is slung across the back.

(4) The round can be cocked to the side so the gunner is able to see. He should not attempt to move while looking through the CLU.

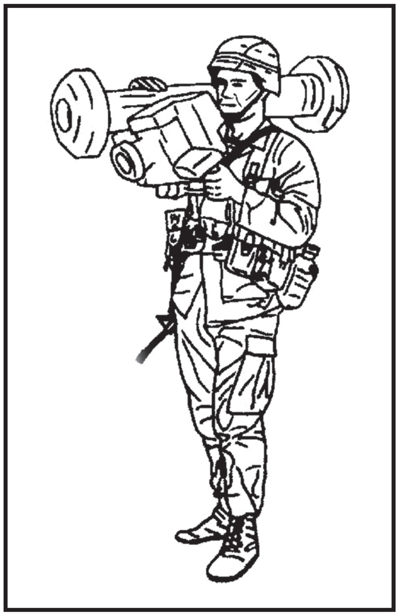


Figure 2-39. Tactical carry technique.

SHORT-DISTANCE CARRY

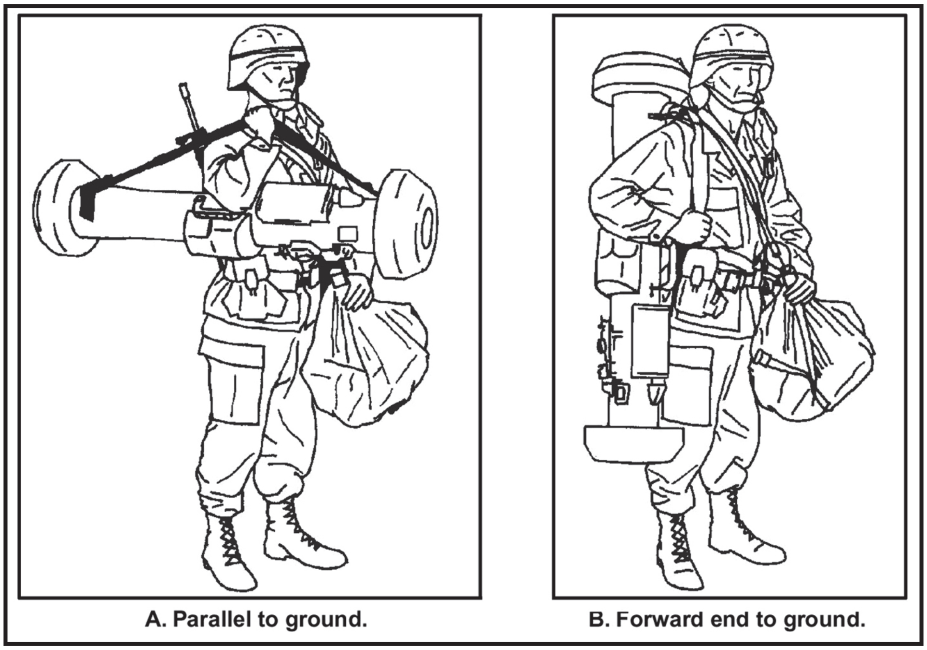
2-69. The short-distance carry technique is used when enemy contact is possible. The rifle is slung over the gunner's left shoulder. The CLU is in the carry bag. The carry bag is carried on the gunner's left side with the shoulder strap over the left shoulder or across the chest. Using the short-distance carry technique, the round can be carried in one of two ways.

Round Parallel to Ground

2-70. The round is carried on the gunner's right side with the shoulder strap over the right shoulder. The round is parallel to the ground, waist high with the forward end cap pointed in the direction of movement. The gunner's right hand may be placed on the shoulder strap to keep the round from swaying and to help keep the shoulder strap on the shoulder (Figure 2-40A).

Round Forward End Pointed Down

2-71. The round is carried on the gunner's right side with the shoulder strap over the right shoulder. The forward end cap is pointed down with the round behind the right shoulder, parallel to the gunner's body. The gunner's right hand may be placed on the shoulder strap to help keep the strap on the shoulder (Figure 2-40B).



A. Parallel to ground.

B. Forward end to ground.

Figure 2-40. Short-distance carry techniques.

LONG-DISTANCE CARRY

2-72. The long-distance carry technique is used when contact is not likely (Figure 2-41).

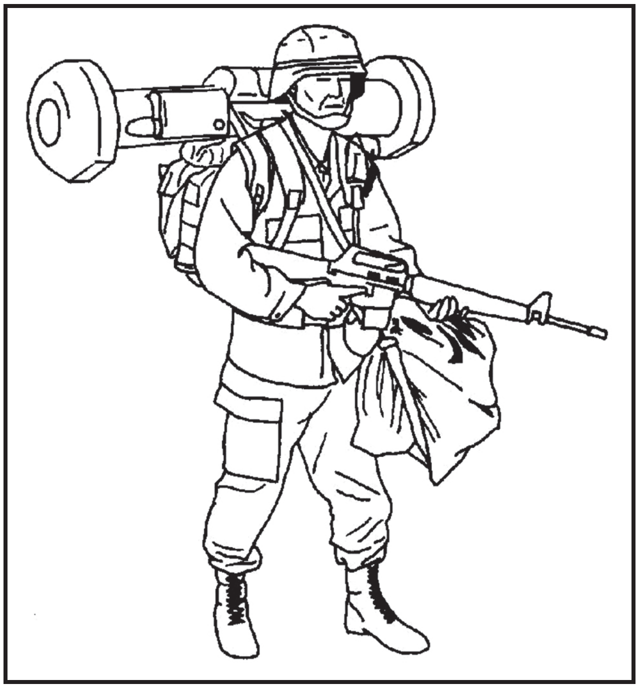


Figure 2-41. Long-distance carry technique.

Command Launch Unit Carry Position

2-73. To carry the CLU—

(1) Place the CLU in the carry bag.

(2) Ensure the carry bag is on the gunner's left side with the shoulder strap over the left shoulder or across the chest.

(3) Use a second strap on the carry bag to fasten the CLU to the gunner's waist. This procedure prevents the carry bag from bouncing when the gunner walks.

Stowing the Round on a Rucksack

2-74. To stow the round on a rucksack—

(1) Place the rucksack on the ground with the frame face down and the top of the pack facing away.

(2) Locate the two long web straps extending from the top of the frame and across the front of the pack (Figure 2-42).

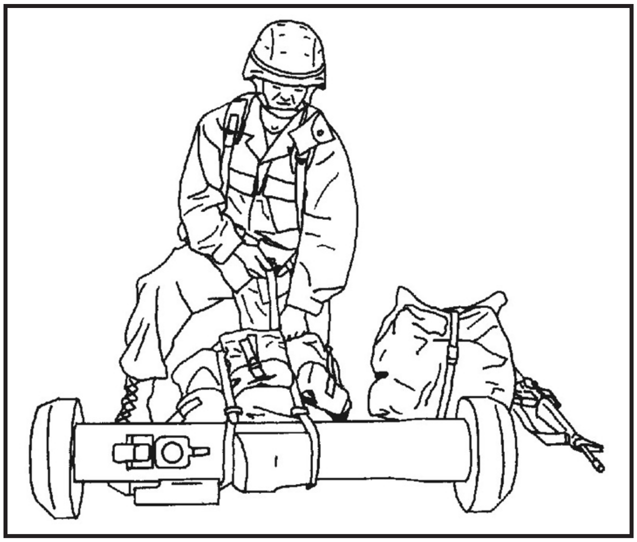


Figure 2-42. Secure the round to the rucksack.

(3) Open the straps to form a loop at the top of the rucksack frame.

(4) Pick up the round and slide it through the strap loops.

(5) Make sure the BCU is facing forward to prevent damage to it when the rucksack is placed on the ground.

(6) Tighten the straps by pulling on the ends. Continue until the straps are tight.

(7) Place the rucksack on the back making sure the round well balanced and evenly distributed across the top of the frame. Make sure the round is parallel to the ground.

Chapter 3

TRAINING PROGRAM

The Javelin training program integrates the Javelin into the overall unit training program to increase combat readiness and ensure that trainers and gunners are proficient in operating and maintaining the Javelin.

SECTION I. GENERAL

The commander should conduct an accurate assessment to determine the initial and sustainment training required to maintain the proficiency of assigned Javelin gunners. Unit training programs should include Javelin gunner training; the unit's battle focus and mission-essential task list (METL); and the supporting Soldier, leader, and collective tasks.

TRAINING STRATEGY

3-1. The Javelin training strategy is composed of five primary components:

- Initial training.
- Sustainment training.
- Collective training.
- Force-on-force training.
- Leader training.

INITIAL TRAINING

3-2. Initial gunner training is a prescriptive program of instruction (POI) conducted at the institution and in the unit. This training consists of two weeks of instruction, culminating in the successful completion of the gunner's skill test (GST).

SUSTAINMENT TRAINING

3-3. Sustainment training ensures retaining skills learned during initial training. This training takes place entirely in the unit: monthly, bimonthly, quarterly, and annually. Gunners must retain their skills by practicing engaging targets at least monthly. The gunner fires selected engagements from the monthly sustainment exercises using the BST. The gunner practices field engagements using the FTT every other month. Once a quarter, the gunner completes the entire GST. If the gunner does not perform satisfactorily, he should be retrained until he qualifies.

COLLECTIVE TRAINING

3-4. Collective training takes place in the unit to integrate the Javelin into the unit's overall combat power. The Javelin is integrated into collective training using the FTT. Force-on-force training is conducted with the FTT during squad platoon, company, and battalion field training exercises (FTXs)/situational training exercises (STXs).

LEADER TRAINING

3-5. Leader training is conducted in both the institution and the unit. Leaders are taught to train, maintain, and employ the Javelin in courses such as Officer and Noncommissioned Officer Education Systems (OES and NCOES, respectively) This training must continue in units formally through noncommissioned officer (NCO) and officer development classes and informally through personal initiative.

3-6. Javelin leadership training begins with the basic understanding of the Javelin, its capabilities and limitations, moves to understanding the fundamentals of Javelin tactical employment, and includes how to integrate the Javelin into company level training.

3-7. Leaders must learn how to employ the Javelin and integrate it into their units. Tactical exercises without troops (TEWT) can be used to develop leaders' tactical understanding. (For more information about tactical employment considerations, see Chapter 4.) Gunners may also be employed with their squads to help train other squad or fire team members to perform their duties (providing security, locating targets, etc.). After-action reviews (AAR) should be conducted after all training exercises, and recommendations should be provided to the commander so that Javelin security, operation, and employment considerations can be more effectively integrated into the unit training plan.

PREREQUISITES FOR ADDITIONAL SKILL IDENTIFIER

3-8. Normally, the 2C (Javelin Gunner) additional skill identifier (ASI) is awarded at the completion of institutional training; however, initial gunner training can be conducted by the unit when school-trained gunners are not available. This training should only be conducted by qualified Javelin trainers, and only on an as needed basis, to maintain qualified gunners at the battalion level and above. The course must be conducted in accordance with (IAW) the Javelin POI established by the USAIS.

NOTE: Units must provide qualified instructors who have completed the Basic Noncommissioned Officer Course (BNCOC) and who are certified to conduct initial gunner training, or who have completed the train-the-trainer program. The unit must contact the Javelin course at USAIS for approval to conduct the Javelin Gunner's Course (JGC). USAIS oversees and monitors all non-resident Javelin courses.

SECTION II. TRAIN THE TRAINER

The train-the-trainer program develops selected unit leaders into competent trainers prepared to teach other Soldiers how to become Javelin gunners. To ensure trainer longevity, commanders should ensure that only those personnel recently assigned are chosen to attend the Javelin train-the-trainer program.

TRAIN-THE-TRAINER PROGRAM

3-9. The train-the-trainer program provides unit-selected Javelin trainers with the skills and knowledge necessary to teach gunners to apply Javelin gunner techniques. During this program, trainers will also learn to develop and maintain a Javelin training program by which the unit can sustain individual gunner proficiency. Soldiers attending this training receive instruction on—

- Planning and scheduling Javelin training.
- Setting up, operating, and maintaining Javelin training equipment.
- Conducting individual and force-on-force training.
- Coaching gunners on engagement skills.
- Evaluating gunner training weaknesses.
- Qualifying gunners.
- Maintaining training records.

INITIAL TRAINING

3-10. The Soldier designated to become a trainer receives 40 hours of Javelin instruction taught by the USAIS. The course consists of four modules: Module 1, Course Introduction; Module 2, Introduction to the Javelin; Module 3, Basic Skills Trainer Operating Instructions; and Module 4, Field Tactical Trainer Operating Instructions.

Module 1: Course Introduction

3-11. This module covers course orientation and applicable training materials. The provided materials give the unit trainer an insight into the 40-hour course of instruction, Javelin training requirements, and the expected course outcome.

Module 2: Introduction to the Javelin

3-12. This module covers the operational capabilities of the Javelin and its major components.

Module 3: Basic Skills Trainer Operating Instructions

3-13. This module covers the use and operation of the BST, the primary training device used for developing the technical skills required to become a Javelin gunner and for qualifying Javelin gunners.

Module 4: Field Tactical Trainer Operating Instructions

3-14. This module covers the use and operation of the FTT, a critical element in developing Javelin gunner proficiency. The FTT is used to develop the skills required to engage targets under field conditions.

SUSTAINMENT TRAINING

3-15. After trainers complete the initial gunner training and Javelin device operational training, they learn to develop a unit training program. The trainers' sustainment training includes practicing the exercises in the BST annex and the FTT exercises in Table 3-1. The last piece of course instruction addresses the planning and frequency of Javelin gunnery, and the documentation (recording and maintaining gunner records) associated with training and qualification.

PROGRAM AUDIENCE

3-16. The train-the-trainer program has two target audiences: potential trainers and potential coaches.

TRAINERS

3-17. Trainers are proficient with the Javelin and can teach others to become Javelin gunners and coaches. These Soldiers should be selected from the most highly qualified Soldiers in the unit.

COACHES

3-18. Coaches are Javelin gunners who can demonstrate the necessary warrior skills to assist other Soldiers in learning basic Javelin gunnery skills. These Soldiers should be selected from unit gunners who possess the desire and ability to train other Soldiers. Coaching has a two-fold benefit: (1) the coach learns and retains the subject matter through repetitive training and demonstrated leadership skills, and (2) other gunners can benefit from the one-on-one assistance.

STANDARDS FOR TRAINERS

3-19. Javelin instructors meet the same standards as Javelin gunners. Successful gunner experience is an asset, but it is not necessarily an indicator of a good instructor. Each instructor must have the confidence, willingness, knowledge, and skills required to train Soldiers to become consistent and effective Javelin gunners in combat. Once selected, the instructors must have successfully completed a train-the-trainer course. The unit commander is encouraged to periodically evaluate each trainer.

RESOURCE REQUIREMENTS

3-20. When preparing Javelin instruction, the unit trainer determines the number of gunners to be trained, the time frame for the training, and the resources required. At the beginning of each training module, Soldiers attending institutional or unit Javelin courses receive a training support package that provides a checklist of training requirements.

TRAINING SUPPORT PACKAGES

3-21. Javelin training support material is continually reviewed and updated by the Javelin training team at the USAIS at Fort Benning, Georgia. There are two sets of media packages for the Javelin: Training Device Course (TDC) and JGC. The entire JGC is presented in media packages featuring up-to-date information and sound and video elements. A current version of the training materials can be downloaded from the USAIS website.

TRAINING DEVICES

3-22. The Javelin weapon system includes three training devices: the BST, the FTT, and the MSR.

BASIC SKILLS TRAINER

3-23. The BST is the primary trainer used to train and qualify Soldiers on the Javelin. The BST consists of two major assemblies: an instructor station and a Soldier station (Figure 3-1). The instructor station consists of a personal computer equipped with special hardware and software, and the Soldier station consists of an SCLU and an MSR. A cable links the Soldier station with the instructor station.

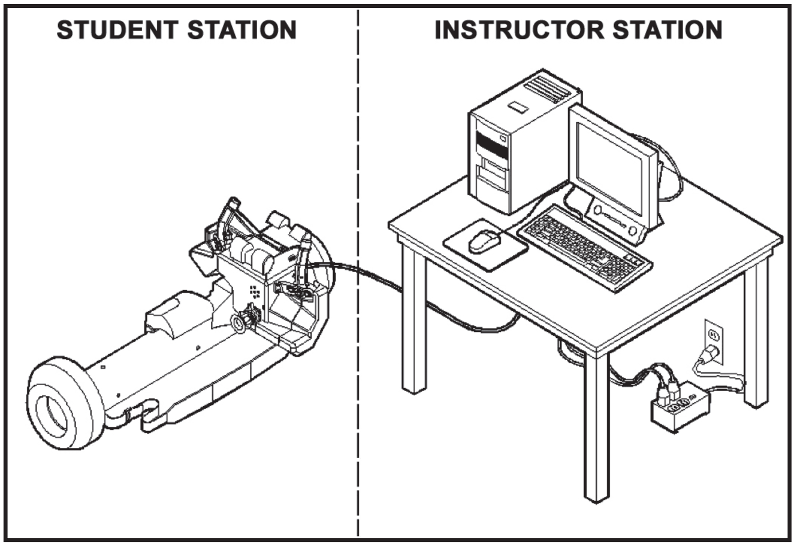


Figure 3-1. Basic skills trainer.

Instructor Station Features

3-24. At the instructor station, a desktop personal computer provides the means to install or upgrade software, create and save gunner training records, and monitor gunner performance during a given exercise. BST operators can enter and save gunner training record data on a 3.5-inch disk. The instructor station also allows the operator to monitor the gunner's actions during each exercise. After the exercise is over, the BST operator can critique the gunner's performance by replaying the exercise.

Training Exercises

3-25. The BST contains training exercises for initial Javelin training and qualification, with two retest exercises for each qualification exercise. Initial training and qualification exercises are stored in separate directories, with expansion directories for sustainment and advanced gunnery training. The exercises contain terrain models, three-dimensional target models, weather conditions (i.e., clear, rain, snow, etc.), run times (1 to 7 minutes), and malfunctions (i.e., hangfire and misfire).

Soldier Station Features

3-26. The Soldier station equipment simulates the physical and operational characteristics of the Javelin, including weight, point of balance, dimensions, hardware components, controls, and indicators. It reproduces simulated battlefield imagery, visual indicators that the gunner uses during target engagement, and operational sounds from a built-in speaker system.

Simulated Imagery

3-27. The computer-generated IR and daylight imagery reflects the magnification and spectral capabilities of the Javelin. BST training exercises use digital images of real terrain from actual visible light and IR imagery. As the gunner works through an exercise, identical imagery is displayed on the instructor station.

Simulated Battery Coolant Unit Removal and Replacement

3-28. The simulated BCU is fixed to the simulated round and cannot be removed during normal use. The Soldier explains the actions that he would take to do so, and the BST operator removes and replaces the BCU by an input at the instructor station.

FIELD TACTICAL TRAINER

3-29. The FTT is a fully integrated, three-dimensional force-on-force training device consisting of an instructor station, a simulated round, a battery charger, and batteries (Figure 3-2). The round incorporates a MILES laser transmitter to allow simulated Javelin engagements during training exercises. The FTT is designed to simulate the Javelin's operational and engagement parameters (Figure 3-2).

NOTE: A Javelin CLU is required, but it is not a component supplied with the FTT.

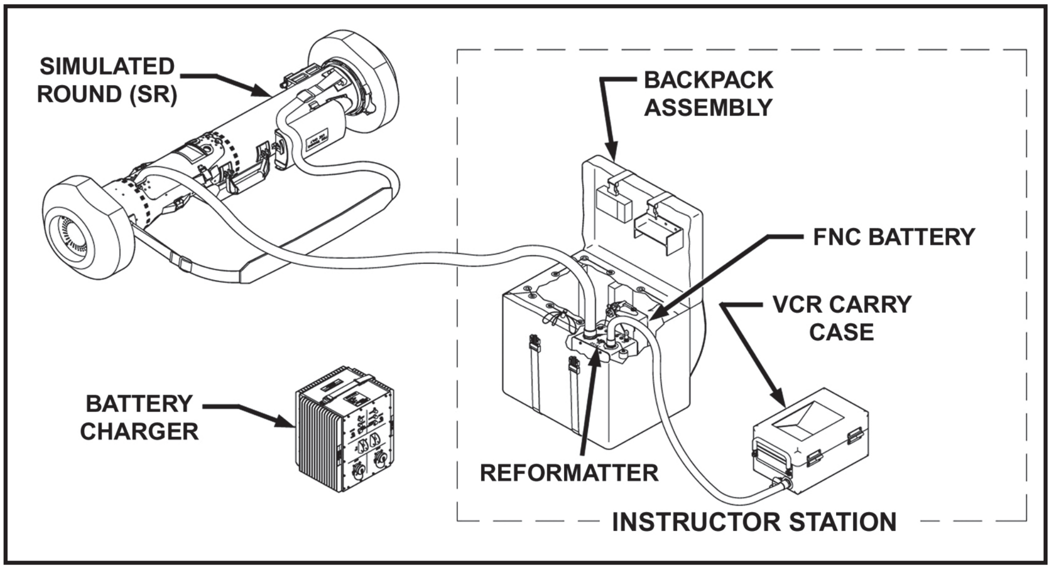


Figure 3-2. Field tactical trainer.

Field Tactical Trainer Instructor Station

3-30. The FTT instructor station consists of a backpack assembly that contains a video camera recorder (VCR), a reformatter, and a fiber nickel cadmium (FNC) battery. The instructor station adds the capability of monitoring, recording, and reviewing gunner activities on 8-millimeter videotape.

Field Tactical Trainer Simulated Round

3-31. The FTT simulated round is used to simulate the actual Javelin round and weighs slightly more (about 2 pounds). Using the video from the NVS-WFOV, the round simulates Javelin seeker imagery and inserts crosshairs and track gates; then, it sends the image to the CLU display.

Battery Charger

3-32. The battery charger is used to charge the FNC battery that powers the simulated round and the instructor station.

Fiber Nickel Cadmium Batteries BB390 for the Command Launch Unit

3-33. These are for training use only.

Command Launch Unit

3-34. The CLU interfaces with the simulated round through an interface connector and the W1 cable.

MISSILE SIMULATION ROUND

3-35. The MSR is used to teach gunners how to handle, maintain, and carry the round. It consists of a simulated launch tube that contains no instruments or circuitry, but has the weight and balance of the live Javelin round.

BASIC SKILLS TRAINER SETUP OPERATIONS

3-36. The BST allows training gunners in a realistic training environment. This training is conducted indoors using computer-generated terrain and target vehicles. The Javelin instructor must have the following knowledge to use the BST effectively:

- Major components, equipment characteristics, capabilities, and features.
- Basic operation of the Javelin.
- How to prepare the BST for operation.
- How to conduct daily readiness check procedures.
- How to prepare and maintain a Gunner Training Record.
- How to prepare and conduct a BST exercise.
- How to apply BST troubleshooting procedures.
- How to maintain a BST.
- How to prepare a BST for shipment or storage.

SETUP REQUIREMENTS

3-37. The BST is self-contained and comes in two transit cases containing the instructor station and the Soldier station. The instructor station transit case contains the Javelin BST setup instructions. The instructions explain how to set up the BST and include a wiring diagram.

OPERATIONS

3-38. Once the instructor station has been turned ON, the BST software icon is selected, and the Javelin Main Menu window appears on the monitor, the instructor can select from the following directories:

- Daily readiness check.
- Exercise editor.
- Javelin training.
- IR training.
- Exit.

3-39. From this point on, the instructor can decide where he wants to go. The program is menu-driven.

EXERCISES

3-40. The Javelin exercises and exercise upgrades provided by the Javelin Project Management Office are reviewed periodically by the USAIS. System upgrades are managed by the Javelin Project Manager.

COACHING TECHNIQUES

3-41. The instructor station allows the trainer/coach to see what the gunner sees as he works through the performance steps. The various exercises work toward one goal—a gunner who can detect, identify, and successfully engage targets with the Javelin. The trainer/coach helps the gunner work through the various exercises to develop techniques to engage the enemy. The BST records these exercises so that the coach and gunner can review the events that occurred. The immediate feedback allows the gunner to review his actions and learn from his successes and mistakes.

CONDUCT BASIC SKILLS TRAINER EXERCISES

3-42. The trainer/coach should have a complete understanding and the expertise to perform the following tasks:

(1) Set up the instructor and Soldier stations. Perform a system check to ensure that they are properly assembled.

(2) Provide the gunner's briefing.

(3) Ensure that gunners assume the best firing position possible and that they always check the backblast area before firing. The Javelin is balanced so the gunner can easily hold the Javelin steady, acquire a target, and engage it. If the position is awkward, the gunner tires quickly, making it more difficult for him to hold the Javelin steady while operating CLU control switches.

(4) Watch the gunner adjust the focus adjustment ring. Ensure that the adjustment compensates for the gunner's vision by asking the gunner to scan and identify targets.

(5) Guide the gunner through making necessary sight changes (i.e., when the target scene changes). The brightness and contrast controls must be adjusted for changing conditions.

(6) Observe the gunner as he selects the FOV and the method of scanning (rapid, slow, or detailed; day or night). Make notes for the AAR.

NOTE: The gunner should use the WFOV for scanning.

(7) Follow the gunner as he looks at his sector of fire to ensure that he covers the sector completely and detects any sounds from or physical evidence of nearby vehicles. For example, does the gunner hear any engine noises or see any vehicle exhaust or dust clouds?

NOTES:

1. The gunner should use the WFOV to detect targets.
2. During limited visibility conditions, the gunner should look for any light sources, such as a lit cigarette, headlights, or flashlights. During the day, the gunner should look for light reflected from shiny surfaces.

(8) Ensure that the gunner correctly performs target detection and classification. Once the gunner detects a potential target, he must classify it as wheeled or tracked and recognize it as friendly or enemy. The coach and gunner should talk to each other during this process. For example, the coach may ask the gunner what makes the target friendly or enemy, or the gunner may have to identify the types of vehicles.

NOTE: The gunner should use the NFOV for classification and recognition.

(9) Ensure that the gunner correctly performs seeker lock-on and target engagement procedures. To achieve seeker lock-on, the gunner must be able to adjust the track gates (see Chapter 4). Observe where the gunner places the track gates on the target. This adjustment is a critical step. Make sure that the gunner gets a good lock on the target. Observe the gunner to ensure that he smoothly transitions into locking on the target, and follow the gunner during moving target engagements. Once the gunner has identified the target as enemy, the gunner should achieve seeker lock-on and fire.

(10) Conduct an AAR. The critique provides feedback to the gunner concerning his performance during the exercise. There are several steps to the critique, including providing the score computed by the BST, viewing a replay of the exercise, and determining whether to override the exercise pass/fail status assigned by the BST. Critique the gunner's performance by interpreting the system comments and providing an evaluation IAW paragraph 7 of the exercise summary sheet. Record comments in the instructor's comment area of the Exercise Critique window.

FIELD TACTICAL TRAINER SETUP OPERATIONS

3-43. The FTT allows gunner training to be conducted in a field environment with actual target vehicles. To use the FTT effectively, the Javelin trainer must be familiar with the Javelin's major components, equipment characteristics, capabilities, and features; understand basic Javelin operation; and know how to—

- Prepare the FTT for operation.
- Program an FTT using training exercise menus.
- Prepare the instructor station for use with an FTT.
- Conduct daily readiness checks.
- Prepare and maintain a gunner training record.
- Prepare and conduct an FTT exercise.
- Monitor, record, and playback gunner training.
- Apply FTT troubleshooting procedures with or without an instructor station.
- Maintain an FTT with the instructor station.
- Prepare an FTT for shipment or storage.

SETUP REQUIREMENTS INCLUDING BORESIGHT PROCEDURES

3-44. See the Training Device Module 4—FTT Operating Instructions. It provides step-by-step instructions on how to set up the FTT and conduct boresight procedures.

OPERATIONS

3-45. See Training Device Module 4—FTT Operating Instructions.

EXERCISES

3-46. FTT training is conducted in the field. Its execution varies based on the environment and assets at hand.

COACHING TECHNIQUES

3-47. The FTT instructor station has the ability to video capture the exercise. This allows the trainer/coach to observe the gunner's actions and record the engagement. The trainer/coach and gunner can review the exercise together and critique each engagement during the AAR.

GUNNER'S SKILL TEST EXECUTION

3-48. The GST evaluates the gunner's skills and is used to qualify Javelin gunners. It consists of a BST test, an FTT test, and a range card exercise (conducted in any sequence). Gunner supporting tasks are listed in paragraphs 3-74 to 3-82.

BASIC SKILL TEST

3-49. The BST portion of the GST consists of a series of exercises used to evaluate the following skills:

- Assume a Javelin firing position and demonstrate how to engage a target.
- Replace a spent BCU.
- Apply Javelin misfire procedures.
- Engage two or more targets.
- Terminate an engagement.
- Re-engage a target after break-lock.
- React to a malfunction or warning indicator.

FIELD TACTICAL TRAINER

3-50. The FTT portion of the GST consists of five stations. The following skills are evaluated:

- Engage a target.
- Engage two or more targets.
- Terminate an engagement.
- Re-engage a target after break-lock.
- Demonstrate the Javelin carry techniques using an FTT.
- Change the missile mode, if necessary.

RANGE CARD EXERCISE

3-51. The gunner is required to correctly prepare a standard range card IAW information found in Appendix B.

SECTION III. TRAIN THE GUNNER

The JGC, an 80-hour POI, is the base training for the Javelin gunner. The course curriculum covers a series of instructor lectures and a combination of hands-on practice exercises (PEs) and paper evaluations. Three training devices—the BST, the FTT, and the MSR—are used during the training, as well as the CLU and training aids.

CONDUCT OF TRAINING

3-52. Training the gunner on the basic skills needed to engage and destroy enemy targets begins in the classroom learning the Javelin and its capabilities. The gunner then learns how to engage targets using the BST and reacts to warning indicators and malfunctions. The next step in training the gunner is how to operate the FTT. Using a combination of lecture, demonstration, and hands-on training, the trainer is able to teach the gunner how to become an effective Javelin gunner. The gunner is finally evaluated using a series of tests on the BST, FTT, and standard range card. See Table 3-1, a notional training schedule.

Table 3-1. Javelin 10-day (80-hour) training schedule.

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Module 1 Course Intro	Module 3 (cont.)	Module 5 (cont.)	Module 6 (cont.)	Module 6 (cont.)
Module 2 Intro to Javelin	Module 4 IR Images Target Acquisition.	Module 6 Target Engagement System Malfunctions (BST)		
LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
Module 2 (cont.)	Module 4 (cont.)	Module 6 (cont.)	Module 6 (cont.)	Module 6 (cont.)
Module 3 Prepare Restore Carry	Module 5 Target Engageability			
DAY 6	**DAY 7**	**DAY 8**	**DAY 9**	**DAY 10**
GST - BST	Module 7 FTT	Module 7 (cont.)	GST - FTT	Module 8 Maintain Javelin
LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
GST - BST (cont.)	Module 7 (cont.)	Module 7 (cont.)	GST - FTT (cont.)	Course Critique
				Graduation

PROGRAM EXECUTION

3-53. The gunner's training program is designed to be taught in 10 days. Many units may not be able to dedicate personnel and equipment assets for consecutive daily training. If this is the case, the schedule can be modified, but units must avoid reducing the content of any training period. Each POI is unique and plays an important part in the overall performance and understanding of the gunner. Units modifying the schedule should keep the time between training periods as short as possible. When a gap occurs between training events, a review of previous training must be planned at the start of the next training period. Negative results are achieved when the training schedule is shortened. Units must consider the following factors when deciding to modify (lengthen or split training periods/programs) their gunner qualification program:

- Quality of instruction must be maintained.
- Tasks must be taught in a logical sequence.
- Instructor continuity must be maintained.

CENTRALIZED TRAINING

3-54. Centralized Javelin training is highly recommended. The decision to use centralized training depends on the availability of the following training resources:

- Equipment and facilities.
- Personnel.
- Time.
- Tasks.

3-55. Centralized training establishes and maintains unit standards, but should not replace or undermine the small unit leader. It should maximize the limited resources because the available number of training devices may limit the choice to centralized training.

EQUIPMENT AND FACILITIES

3-56. Control of the BST and FTT should be centralized.

PERSONNEL

3-57. A train-the-trainer program is developed to maintain a pool of trainers for a successful training program at the unit level. At least one Soldier at the company level should be trainer-qualified.

TIME

3-58. Until a train-the-trainer program has produced a sufficient number of trained Soldiers, centralized training is conducted to save time and resources.

TASKS

3-59. When considering centralized training, the commander identifies the tasks required to achieve training objectives and support the unit METL. Tasks that are not critical are taught during individual or unit sustainment training.

TRAINING OBJECTIVES

3-60. Training objectives are statements that describe what the gunner should be able to do at the end of the lesson. Each training objective consists of three statements: an action, the conditions, and the standards.

ACTION

3-61. The "action" statement describes a clearly defined and measurable activity that the gunner must accomplish.

CONDITIONS

3-62. The "conditions" statement defines the circumstances and environment in which the gunner must perform the activity defined in the "action" statement.

STANDARDS

3-63. The "standards" statement defines the minimum acceptable proficiency at which the gunner must perform the activity defined in the "action" statement.

PRACTICE EXERCISES

3-64. A PE is a tool used to determine if Soldiers understood the information received during the instruction. PEs may be conducted as either a written or a hands-on exercise.

WRITTEN EXERCISE

3-65. A written exercise verifies how well Soldiers retained information given for knowledge-based tasks (i.e., system capabilities, etc.). A written exercise may be a fill-in-the-blank, multiple choice, or matching exercise.

HANDS-ON EXERCISE

3-66. A hands-on exercise determines how well Soldiers perform with the Javelin equipment (i.e., preparing the Javelin for firing, engaging targets, assuming carry configurations, and restoring the Javelin to a carry configuration). During a hands-on exercise, Soldiers should use tactical equipment or a training device to perform the action, while having their actions checked against a checklist.

EVALUATION SYSTEM

3-67. Soldiers' progress is evaluated throughout the course using PEs. A GST is given at the end of the course.

PRACTICE EXERCISES

3-68. This training method provides input on Soldier retention. A PE gives the Soldier a chance to practice the Javelin gunner skills learned in class. It is not a test, but the Soldier is evaluated to provide feedback on proficiency of those skills. If the Soldier is given a “T” (trained), he is considered trained on that information. If the Soldier is given a “P” (practice), he should be given additional time to practice those skills or reread the information, and retested immediately. If the Soldier receives a “U” (untrained), he should receive additional training to ensure that he did not misunderstand the principles involved.

GUNNER'S SKILL TEST

3-69. During the GST, Soldiers are evaluated in three areas: the BST, the FTT, and range card preparation.

Basic Skills Trainer

3-70. Soldiers are required to complete 11 qualification exercises on the BST. In each of these exercises, he will be graded automatically by the BST and on observations made by the instructor. The minimum standard for any qualification exercise is 70 percent. To pass, he must achieve the minimum score on all 11 qualification exercises. If a Soldier receives a “NO GO” for any qualification exercise, he will have up to two opportunities to retest on that exercise.

Field Tactical Trainer

3-71. During the FTT portion, the Soldier will rotate through five stations—one for maintenance and the other four for firing at targets on a range. At each firing station, he will be given instructions similar to those that a Javelin gunner would receive upon arrival at a fighting position. He is expected to carry out those instructions just as he has learned to do during the course. When he rotates from one station to another, he will be told to assume a specific carry configuration, which will be graded. At each station, he will be graded as a “GO” or a “NO GO.” To pass, he must receive a “GO” at all stations.

Range Card Preparation

3-72. During the range card preparation, he will complete a standard range card as he was taught in class. This portion is graded as “GO/NO GO.” To pass, he must receive a “GO.”

SAFETY

3-73. Safety is everyone’s responsibility. Trainers must immediately correct any identified unsafe or harmful acts and conditions, thereby preventing personal injury, illness, and damage to government property. See Appendix A.

GUNNER QUALIFICATION PROGRAM

3-74. The Javelin gunner is qualified by a series of training events beginning with the JGC. The gunner passes the GST to successfully complete the JGC. In the unit, the GST is conducted quarterly. The gunner/trainer sustainment trainer supports the gunner’s qualification program. The Javelin qualification program consists of eight modules:

- Module 1: Introduction to the Course.
- Module 2: Introduction to the Javelin Weapon System.
- Module 3: Preparing, Restoring, and Carrying the Javelin.
- Module 4: Imaging Infrared and Target Acquisition.
- Module 5: Target Engageability.
- Module 6: Target Engagement and Malfunctions.
- Module 7: Field Tactical Trainer.
- Module 8: Maintain a Javelin.

MODULE 1: INTRODUCTION TO THE COURSE

3-75. Although a short module, it sets the tone for the upcoming training. Module 1 lays the foundation for the JGC. It starts with a list of objectives contained in each module. In the body, it provides the administrative information, as well as course structure, objective, schedule, overview, reference materials, and evaluation system.

MODULE 2: INTRODUCTION TO THE JAVELIN WEAPON SYSTEM

3-76. Module 2 provides information on Javelin capabilities, major components, controls, and indicators. Gunners need this information to understand the remainder of the JGC. Module 2 consists of the following training objectives:

ACTION: Describe the operational capabilities of the Javelin.
CONDITION: From memory. Given a set of fill-in-the-blank questions.
STANDARD: Answered at least 12 of 16 questions correctly.

ACTION: Identify the major components of the CLU.
CONDITION: Given a CLU or a line drawing of the CLU.
STANDARD:
1. Identified at least 6 of the 8 major CLU components (handgrips, battery compartment, daysight, eyepiece, NVS, DDC, absorbers, and round interface connector).
2. Matched at least 6 of the 8 major CLU components with their functions.

ACTION: Identify the CLU controls.
CONDITION: Given a drawing of a CLU.
STANDARD:
1. Identified at least 7 of the 9 CLU controls (diopter adjust ring, POWER switch, FLTR switch, FOCUS switch, SGT SEL switch, seeker trigger, GATE ADJ/CTRS & BRT switch, ATTK SEL switch, and fire trigger).
2. Matched at least 7 of the 9 CLU controls with their functions.

ACTION: Identify the CLU status indicators.
CONDITION: Given drawings of the CLU display with the status indicators.
STANDARD:
1. Identified at least 14 of the 20 status indicators (CLU power LED, CLU BIT LED, DAY, WFOV, NFOV, WHITE HOT, BLACK HOT, E-ZOOM OFF 2X, E-ZOOM OFF, FLTR, NVS NOT COOL, CLU BIT FAILURE, CLU BATTERY, MSL CONN, MISSILE NOT READY, SEEK, TOP, DIR, BCU, and MISSILE BIT FAILURE).
2. Matched at least 14 of the 20 status indicators with their functions.

ACTION: Identify the major components of the round.
CONDITION: Given an MSR or a line drawing of the round.
STANDARD:
1. Identified at least 6 of the 8 major components of the round (launch tube, forward end cap, aft end cap, carry handle, shoulder strap, BCU, shoulder pad, and latch assembly).
2. Matched at least 6 of the 8 major components of the round with their functions.

ACTION: Identify the round controls.
CONDITION: From memory. Given a list of functions and a list of round controls.
STANDARD:
1. Identified at least 5 of the 7 round controls (seeker trigger/trigger guard, SGT SEL switch, ATTK SEL switch, GATE ADJ/CTRS & BRT switch, fire trigger, and manual release button).
2. Matched at least 5 of the 7 round controls with their functions.

ACTION: Identify the round indicators.
CONDITION: From memory. Given a list of functions and a list of round indicators.
STANDARD:
1. Identified at least 3 of the 4 round indicators (BCU status indicator, humidity indicator, track gates, and crosshairs).
2. Matched at least 3 of the 4 round indicators with their functions.

MODULE 3: PREPARING, RESTORING, AND CARRYING THE JAVELIN

3-77. Module 3 covers preparing the Javelin for firing, assuming the Javelin firing positions, restoring the Javelin to a carry configuration, and employing the Javelin carry techniques. Module 3 consists of the following training objectives:

ACTION: Demonstrate the Javelin carry techniques.
CONDITION: Given a Javelin and a carrying bag with all components.
STANDARD: Assumed each of the following carry positions:
1. A tactical carry within 1 minute.
2. A short-distance carry within 1 minute.
3. A long-distance carry within 3 minutes.

ACTION: Prepare a Javelin for firing.
CONDITION: Given a CLU, a round, and a carrying bag with all components in either the short-distance or long-distance carry configuration.
STANDARD: Removed the CLU from the carrying bag, installed the BA-5590/U battery, connected the CLU to the round, removed the forward end cap, and opened the lens covers within 2 minutes.

ACTION: Restore a Javelin to a carry configuration.
CONDITION: Given a Javelin in the ready-to-fire configuration, a CLU carrying bag, and a designated carry configuration.
STANDARD: Powered down the CLU, replaced the forward end cap, removed the CLU from the round, and assumed either the short- or long-distance carry position.

ACTION: Assume a Javelin firing position.
CONDITION: Given a Javelin in the ready-to-fire configuration.
STANDARD: Assumed each designated firing position within 60 seconds.

ACTION: Replace a BCU.
CONDITION: Given a Javelin with the seeker activated (but the missile has not been launched) and an unused BCU.
STANDARD: Removed spent BCU and reinstalled a new BCU within 20 seconds.

ACTION: Construct a Javelin fighting position.
CONDITION: TBD
STANDARD: TBD

MODULE 4: IMAGING INFRARED AND TARGET ACQUISITION

3-78. In the first part, Module 4 covers IR theory, the effects of various environmental influences on IR images, and the techniques involved in adjusting the focus, contrast, and brightness to counteract those influences. In the second part, Module 4 covers target acquisition (i.e., how to detect, classify, and recognize them). Module 4 consists of the following training objectives:

ACTION: Describe IR principles.
CONDITION: Given a set of fill-in-the-blank questions.

STANDARD: Described IR principles by correctly filling in all of the blanks for at least 15 out of 20 statements.

ACTION: Adjust NVS focus, contrast, and brightness.
CONDITION: Given 8 sets of target scene images, a CLU, and 5 objects.
STANDARD:
1. Determined in the first target scene whether to adjust the contrast or brightness and the direction of adjustment to obtain the second target scene for at least 6 of the 8 sets.
2. Correctly answered at least 6 of 8 questions about objects viewed through the NVS.

ACTION: Detect, classify, and recognize targets using IR imagery.
CONDITION: Given 12 vehicle videos using IR imagery and 8 IR target images for 8 different vehicles.
STANDARD:
1. Classified 90 percent (10 out of 11) of the vehicles.
2. Recognized 80 percent of the correctly classified vehicles (9 out of the 10 or 11).
3. Correctly matched all of the IR target images in a set with its target aspect for at least 6 of the 8 vehicles.

MODULE 5: TARGET ENGAGEABILITY

3-79. Module 5 describes the use and purpose of the range card and the sector of fire, and the processes involved in completing a standard range card and determining target engageability. Module 5 consists of the following training objectives:

ACTION: Prepare a standard range card.
CONDITION: During the daylight. Given combat equipment, a Javelin, a designated firing position, a sector of fire, target reference data, a DA Form 5517-R (Standard Range Card [LRA]), and a pencil.
STANDARD: Completed a range card within 15 minutes.
Sketched a sector of fire with appropriate sketches and military symbols (arrow between reference point and weapon position with azimuth and distance; left limit; right limit; areas where targets are likely to appear; target reference points [TRPs] and TRP numbers; maximum engagement line [MEL]; all prominent terrain features, natural and man-made; all dead space; unit size, not to exceed company; and magnetic north arrow).
Completed the Data section, including the type of position, type of weapon, correct interval between circles, date, assigned TRPs (direction and range), and avenues of approach ([AAs] direction and range).
NOTE: The range card must be readable and uncluttered.

ACTION: Determine if a moving target is within Javelin range.
CONDITION: Given a Javelin prepared to fire, a sector of fire, and a range card.
STANDARD: Recognized when a target crossed the MEL.

MODULE 6: TARGET ENGAGEMENT AND MALFUNCTIONS

3-80. Module 6 covers the techniques involved in engaging a stationary target, a moving target, and multiple targets; terminating an engagement; and handling warning indicators or malfunctions, including misfires and hangfires. In this module, you will use the BST to perform these actions during hands-on PEs. Module 6 consists of the following training objectives:

ACTION: Engage a target with a Javelin.
CONDITION: Given a BST ready to fire and a firing position.
STANDARD: Detected, classified, and recognized targets; determined target

engageability; activated the seeker; changed the missile mode, if necessary; locked on the target; checked for solid crosshairs and track gates; and launched the missile.

ACTION: Terminate a Javelin engagement.
CONDITION: Given a BST with the seeker activated and one of the following situations:
1. You are ordered to stop the engagement.
2. You cannot establish or maintain a lock on the target.
STANDARD: 1. Engaged another target or aborted the mission.
2. Removed the activated BCU and installed a new BCU.
3. Continued the mission or displaced.

ACTION: Engage multiple targets with a Javelin.
CONDITION: Given a ready-to-fire BST and a firing position.
STANDARD: Engaged a target, reloaded, and then engaged two more targets within 3 minutes.

ACTION: React to warning indicators.
CONDITION: Given a Javelin or BST.
STANDARD: 1. Demonstrated the actions required to clear the warning indicator.
2. Scored at least 70 percent to pass each BST warning exercise.

ACTION: React to a malfunction.
CONDITION: Given a Javelin or BST.
STANDARD: 1. Demonstrated the actions required to correct the malfunction.
2. Scored at least 70 percent to pass each BST malfunction exercise.

MODULE 7: FIELD TACTICAL TRAINER

3-81. Module 7 covers the major components of the FTT and the techniques involved in assembling the FTT, running a daily readiness check, assuming a carry configuration with the FTT, and engaging targets with the FTT. Module 7 consists of the following training objectives:

ACTION: Identify the major components of the FTT simulated round.
CONDITION: Given an FTT simulated round or an illustration of a simulated round.
STANDARD: Identified at least 5 out of 6 FTT simulated round components (latch assembly, simulated battery coolant unit [SBCU], forward end cap, launch effects simulator, battery compartment, and W1 housing [P3 connector]).

ACTION: Identify the FTT instructor station control panel controls and indicators.
CONDITION: Given an FTT instructor station or an illustration of the FTT instructor station control panel.
STANDARD: Identified at least 5 of 6 of the FTT instructor station control panel controls and indicators (PUSH TO TEST switch, LOW BATT indicator, menu display, LASER FIRE indicator, PUSH TO LIGHT switch, and BIT FAIL indicator).

ACTION: Prepare an FTT for operation.
CONDITION: Given a simulated round, a CLU with a carrying bag, a yellow MILES key, a W1 cable, and a BB390 A/U.
STANDARD: Removed the CLU from the carrying bag, installed a BB390A/U in the CLU, set the CLU power switch to NIGHT, connected the CLU to the simulated round, removed the forward end cap, opened the lens covers, installed the W1 cable, powered up the simulated round, and conducted a daily readiness check (DRC).

ACTION: Engage target(s) with an FTT.

CONDITION: Given a ready-to-fire FTT and a firing position.
STANDARD:
1. Detected, classified, and recognized a target.
2. Determined the target's engageability.
3. Activated the simulated seeker.
4. Reacquired the target in the seeker.
5. Changed the missile mode, if necessary.
6. Adjusted the track gates.
7. Locked on the target.
8. Checked the crosshairs and track gates.
9. Fired the FTT.

ACTION: Disassemble an FTT.
CONDITION: Given an FTT and a carrying bag.
STANDARD:
1. Powered down the FTT.
2. Performed the following actions to the simulated round:
    - Removed the W1 cable, the SBCU, and the yellow MILES key.
    - Removed the FNC battery from the simulated round and turned it in for charging.
3. Performed the following actions to the CLU:
    - Removed the CLU from the simulated round.
    - Removed the CLU battery and stored it in the carrying bag.

ACTION: Boresight an FTT.
CONDITION: Given a powered-up FTT, a boresight kit, a small-arms alignment fixture (SAAF), a 9-volt battery, and three 6-volt batteries.
STANDARD: Set up the equipment and boresighted the FTT, achieving a minimum alignment of 1 in both directions.

ACTION: Maintain an FTT.
CONDITION: Given a CLU, a carrying bag with all components, a simulated round, a cleaning cloth, one ounce of detergent, one quart of water, one 2-quart pail, the Operator's Manual for the Javelin Weapon System M98A2, TM 9-1425-1687-10, and the Operator's Manual for the Javelin Missile System Field Tactical Trainer M82 (TM 9-6920-688-10).
STANDARD: Inspected the CLU, the carrying bag, and the simulated round. Removed all dirt and corrosion from each item. Identified, corrected, and reported any deficiencies IAW TM 9-1425-1687-10. Notified the squad leader if items were missing and if any CLU deficiencies were not gunner-correctable.

NOTE: Observe the following safety conditions during training:

- Treat the simulated round as if it were a Javelin round.
- Handle the simulated round carefully to prevent shock or friction.
- DO NOT drop, drag, throw, roll, or "walk" when carrying or transporting the simulated round.
- Handle the simulated round in a way that prevents damage, an accident, or defacing of the identification markings.
- Promptly report any evidence that the simulated round has been handled roughly to the instructor.
- When not in use, ensure that the simulated round (like the round) is pointed away from personnel and toward the area offering the least hazard to personnel and equipment in the event of a fire or explosion.

MODULE 8: MAINTAIN A JAVELIN

3-82. Module 8 covers Javelin preventive maintenance checks and services (PMCS), including inspections, cleanings, BITs, and operational checks.

ACTION:	Maintain a Javelin.
CONDITION:	Given a CLU, a carrying bag with all components, a CLU battery, an MSR, a flashlight with batteries, a cleaning cloth, one ounce of detergent, one stiff bristle brush, one quart of water, one 2-quart pail, and the Operator's Manual for the Javelin Weapon System M98A2 (Army TM 9-1425-1687-10/Marine Corps TM 09397B-12/1).
STANDARD:	Performed PMCS IAW Work Packages 0008 00–0013 00 of TM 9-1425-1687-10, Maintenance Instructions.

NOTES:

1. Before operating the Javelin, review all notes, cautions, and warnings. Perform all before-operation checks IAW TM 9-1425-1687-10.
2. After operating the Javelin, perform after-operation checks and services.
3. The CLU BIT is performed without a round attached.

SUSTAINMENT TRAINING

3-83. The gunners' sustainment training is conducted monthly, quarterly, and annually. The frequency of training may be modified based on the gunner's ability to perform to standards. If a gunner consistently has trouble with a task required quarterly, consider changing that task to a monthly sustainment training program to increase the training frequency and enhance the gunner's ability to perform to standard. The matrix in Table 3-2 identifies the specific tasks and subjects that must be performed by all Javelin gunners and assistant gunners.

COLLECTIVE TRAINING

3-84. Collective training integrates the Javelin into the unit training program and develops an antiarmor resource that the commander and the unit can use to augment their fighting capability. Individual tasks are integrated into collective training and rehearsals. To accomplish this, commanders analyze the collective tasks (from their unit METLs) and the individual tasks supporting them. The commander determines which collective tasks must be practiced by analyzing the mission outlines in the appropriate mission training plan (MTP). The mission outlines describe the collective tasks required to execute each Army Training And Evaluation Program (ARTEP) mission. Leaders determine which individual tasks support the collective tasks by referring to the collective task-to-individual task matrix in the appropriate MTP. Some considerations for planning collective tasks are as follows:

- How does a Javelin that is issued at the squad level affect training?
- Who do I assign as designated Javelin gunner?
- Does the Javelin gunner require an assistant gunner or an ammunition bearer?
- If a second round is issued to the gunner or squad, who carries it?
- If the designated Javelin gunner is injured or killed, who replaces him?
- Who else can be trained?

3-85. Table 3-3 includes some suggested collective training events.

Table 3-2. Sustainment training matrix.

TASK	TRAINING FREQUENCY	TIME	REMARKS
Maintain a Javelin.	M	4 hrs	Practical Exercise MSR/CLU
Prepare a Javelin for firing.	M^1	10 min	Practical Exercise MSR/CLU
Restore a Javelin to carrying configuration.	M^1	5 min	Practical Exercise MSR/CLU
Perform long-distance carry technique.	Q	2 hrs	CLU and MSR
Perform malfunction procedures on a Javelin.	M^1	15 min	Practical Exercise BST and FTT
Recognize friendly and threat armored vehicles and aircraft.	M	30 min	Practical Exercise BST
Explain how to construct a two-man fighting position with a Javelin firing platform.	A	N/A	Perform as part of an ARTEP or FTX
Prepare a standard range card.	M^2	30 min	Practical Exercise
Engage targets with a Javelin. • BST • FTT	M/Q	4 hrs	Practical Exercise BST FTT
Explain immediate decontamination and emergency destruction procedures.	Q	30 min	Perform during BST and FTT training

M = Every month
M^1 = 1st month (odd months)
M^2 = 2nd month (even months)
Q = Quarterly
A = Annual

Table 3-3. Collective training tasks.

SEQUENCE	FREQUENCY (TIME/YEAR)	HOW
Squad, Platoon or Company FTX	4	MILES
Battalion FTX	2	MILES
Platoon/Company Urban Operations Exercise	1	MILES
Gunner LFX	1	Live Round
Externally Evaluated Battalion MTP	1	MILES

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Chapter 4

TACTICAL CONSIDERATIONS

This chapter discusses tactical considerations and limitations of Javelin employment during combat operations. To integrate the Javelin into tactics and techniques, leaders—from the company commander down to the squad leader—must be familiar with the field manuals (ATTP 3-06.11, FM 3-21.8, ATTP 3-21.9, FM 3-21.10, FM 3-21.11, and ATTP 3-21.71) appropriate to the organizations and to the organizational level. This chapter also discusses how to construct a Javelin fighting position, affording the gunner and assistant gunner/ammunition handler good cover and concealment while allowing for the best possible engagement of the enemy.

SECTION I. ROLE AND FUNDAMENTALS

The role of the Javelin is to destroy enemy vehicles out to 2,000 meters. Commanders may use the Javelin's unique capabilities from supporting fire to conducting surveillance to enhance the units' combat power. The Javelin replaces the Dragon in selected Infantry, Armor, and Engineer units.

ROLE

4-1. The Javelin's primary role is to destroy enemy armored vehicles. When there is no armored vehicle threat, the Javelin can be employed in a secondary role of providing fire support against point targets such as bunkers and crew-served weapons positions. In addition, the Javelin CLU can be used alone as an aided vision device for reconnaissance, security operations, and surveillance. In mechanized Infantry units, when Bradley fighting vehicles (BFVs) are part of a combined-arms team with tanks, the Javelin becomes a secondary weapon system. It supports the fires of tanks and tube-launched, optically-tracked, wire-guided missiles (TOWs), covers secondary avenues of approach (AAs), and provides observation posts with long-range sight capability.

CAPABILITIES AND LIMITATIONS

4-2. The Javelin has some unique capabilities that provide the unit with an effective medium close combat missile system. However, the commander should also understand the system's limitations in order to effectively employ the Javelin.

FIREPOWER

Capabilities

4-3. The Javelin has the following capabilities:

- The maximum effective range of the Javelin is 2,000 meters.
- The Javelin has a fire and forget capability. The missile I2R system gives the missile the ability to guide itself to the target when launched by the gunner.
- The Javelin has two missile flight paths:
  - Top attack flight path is designed to impact on top of the target.
  - Direct attack flight path is designed to impact on the side (front, rear, flank) of the target.
- The Javelin gunner is capable of firing up to three missiles within 2 minutes.

- The dual-shaped charge warhead is capable of defeating any known enemy armor.
- The NVS sees little degradation of the target image.
- Countermeasures used by the enemy are countered by the NVS filter.

Limitations

4-4. The Javelin has the following limitations:

- The CLU sight cannot discriminate targets past 2,000 meters.
- The NVS cooldown time is from 2.5 to 3.5 minutes.
- The seeker's cooldown time is about 10 seconds.
- The BCU life, once activated, is about 4 minutes.
- During limited visibility (natural or man-made), rain, snow, sleet, fog, haze, smoke, dust, and night are collectively referred to as limited visibility conditions.
- Night.
  - The day FOV relies on daylight to provide the gunner a suitable target image.
  - The NVS uses the IR naturally emitted from objects. IR crossover is the time at dawn and dusk that the terrain and the target are close enough in temperature to cause the target to blend in with its surroundings.
  - Natural clutter is when the sun heats objects to a close enough temperature that it causes the target to blend in with the surrounding terrain.
  - Artificial clutter occurs when there are man-made objects that emit large amounts of IR (for example, burning vehicles).
  - Heavy fog reduces the capability of the gunner to detect and engage targets.
- The flight path of the missile is restricted in wooded, mountainous, and urban terrain.
- The gunner must have line of sight for the seeker to lock onto a target.

MANEUVER

Capabilities

4-5. The Javelin has the following capabilities:

- The Javelin is man-portable.
- The fire and forget capability allows the gunner to shoot and move before missile impact.
- The soft launch capability of the Javelin allows it to be fired from inside buildings and bunkers.
- The Javelin is maneuverable over short distances for the gunners.

Limitations

4-6. The Javelin has the following limitations:

- The weight of the Javelin makes maneuvering slow over long distances.
- The Javelin round is bulky and restricts movement in heavily wooded or vegetative terrain.

PROTECTION

Capabilities

4-7. The Javelin has the following capabilities:

- The passive IR targeting system used to acquire lock-on cannot be detected.
- The launch motor produces a small signature.
- The fire and forget feature allows the gunner to take cover immediately after the missile is launched.

Limitations

4-8. The Javelin has the following limitations:

- The gunner must partially expose himself to engage the enemy.
- The CLU requires a clear line-of-sight to acquire targets in top attack and direct attack modes.

FUNDAMENTALS OF EMPLOYMENT

4-9. The Javelin is employed based on METT-TC. The Javelin's increased range and lethality gives the commander a greater effect on the battlefield. By applying the following fundamentals of employment, the gunner and his leaders increase the probability of destroying enemy targets and enhances the survivability of the Javelin gunner.

STANDOFF

4-10. The gunner strives to engage enemy vehicles in the 1,000-to 2,000-meter range. The Javelin size and small-launch signature are not easily detected at these distances, and the maximum effective range of most machine guns is about 1,000 meters. Engagement at ranges of less than 1,000 meters exposes the gunner to enemy direct fire weapons and lessens his survivability on the battlefield. By engaging the enemy whenever possible out to 2,000 meters, enemy vehicles are forced to break formation. Mechanized Infantry vehicles are forced to take cover and dismount the Infantry. The result is a change in momentum of the battle for both defensive and offensive operations.

MUTUAL SUPPORT

4-11. The Javelin provides mutual support for other unit assets. Mutual support is established by employing the Javelin in sections and by overlapping sectors of fire between Javelins.

Employing by Sections

4-12. Employment of Javelins by section establishes mutual support between gunners. If one gunner has engaged and is displacing, the other gunner can continue to cover the assigned sector. To achieve this, the Javelins are positioned so that fires directed at one Javelin do not suppress the other Javelins (Figure 4-1).

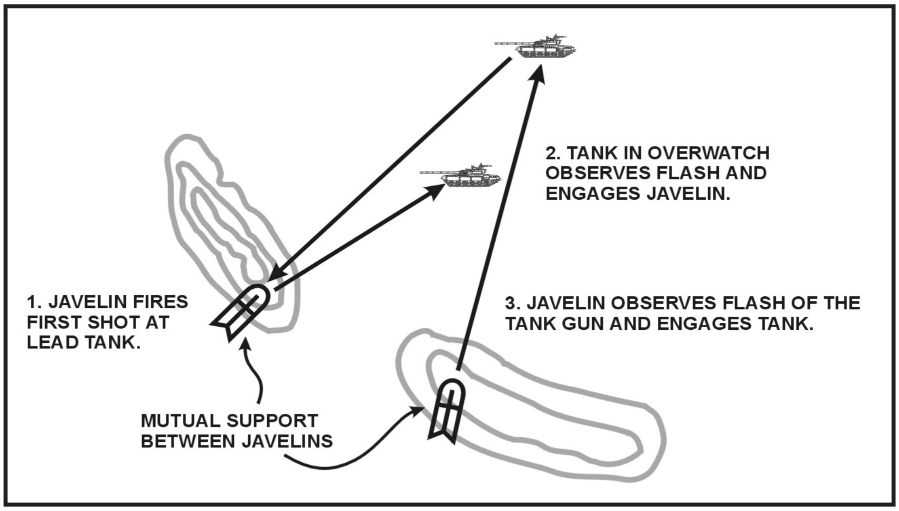

2. TANK IN OVERWATCH OBSERVES FLASH AND ENGAGES JAVELIN.
1. JAVELIN FIRES FIRST SHOT AT LEAD TANK.
3. JAVELIN OBSERVES FLASH OF THE TANK GUN AND ENGAGES TANK.
MUTUAL SUPPORT BETWEEN JAVELINS

Figure 4-1. Mutual supporting fire.

Overlapping Sectors of Fire

4-13. The gunners may overlap sectors of fire to maximize coverage (Figure 4-2). Overlapping sectors of fire are essential to mutual support.

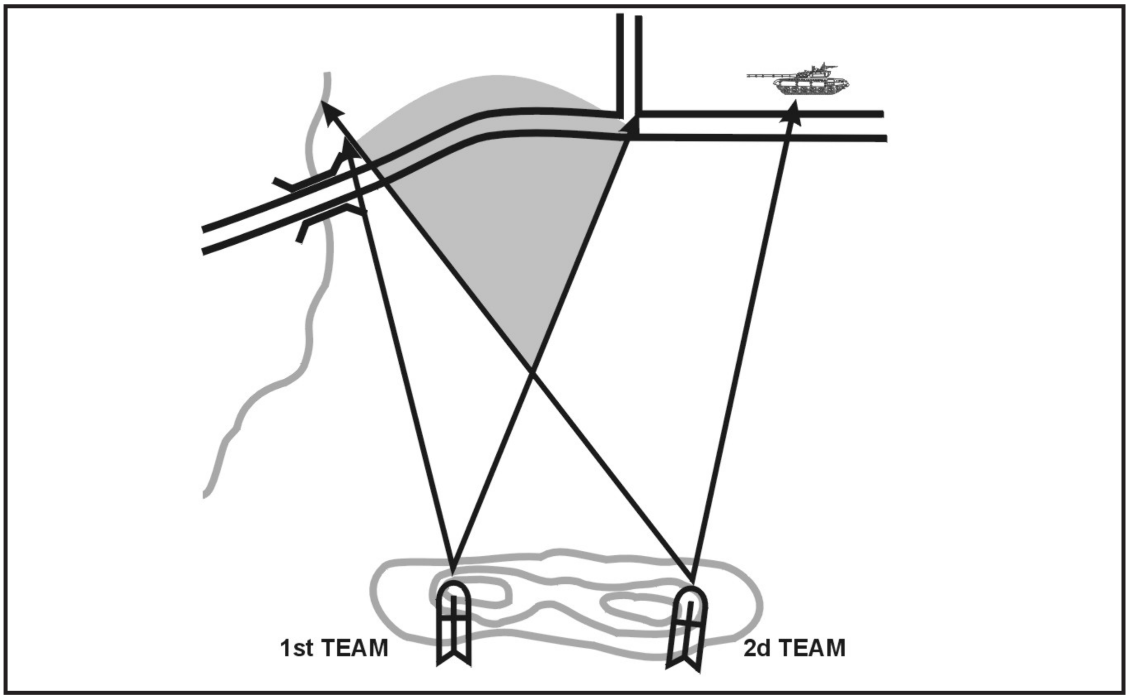


Figure 4-2. Overlapping sectors of fire.

SECURITY

4-14. Javelin gunners are vulnerable to attack by dismounted Infantry. To protect gunners, position them near friendly Infantry units. The Infantry should be able to cover dismounted AAs to the Javelin position.

FLANK ENGAGEMENTS

4-15. The Javelin should be employed to engage enemy vehicles from the flank. Although the Javelin has the unique ability to use a top attack, the gunner should still seek to engage with flank shots.

COVER AND CONCEALMENT

4-16. The Javelin gunners should use cover and concealment to increase their survivability. Cover is protection from the fire of enemy weapons and from enemy observation. It can be natural or man-made. Concealment is protection from enemy observation. Concealment includes not only camouflage but also light, noise, and movement discipline.

EMPLOY IN DEPTH

4-17. Javelin fire should be employed in depth. By employing the Javelins in depth in conjunction with integrated fires and obstacles, the commander prevents the enemy from easily engaging friendly weapon systems and slows and canalizes the enemy advance (Figure 4-3). This increases engagement times for all Javelin systems and the probability of achieving a hit. Positions are selected to capitalize on the Javelin's 2,000-meter range.

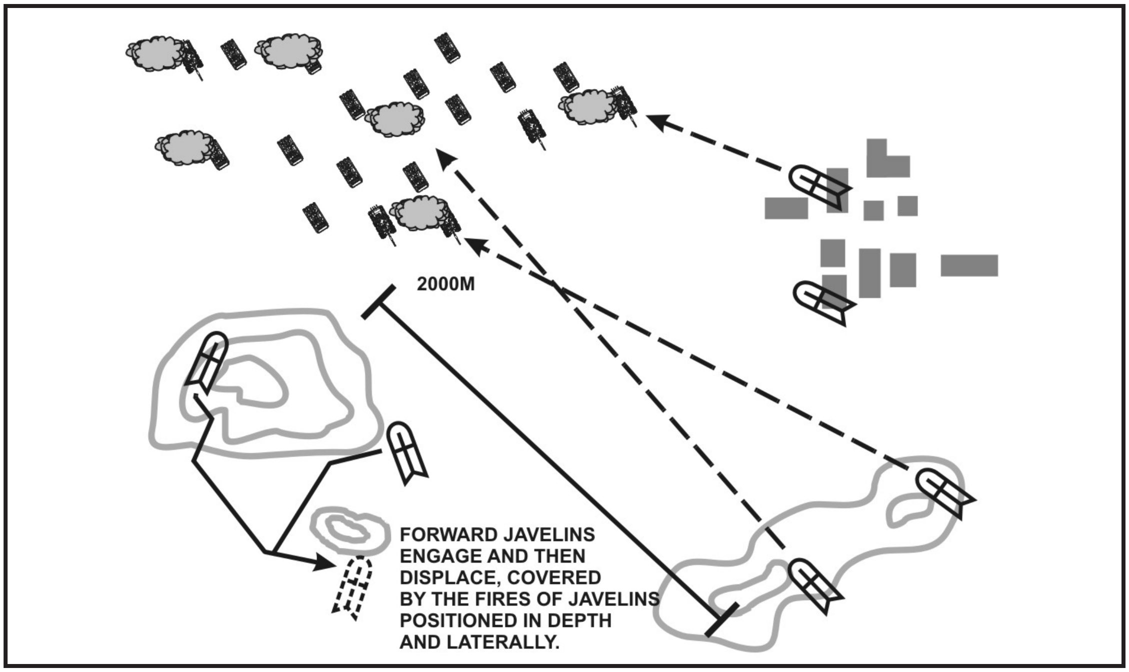

2000M
FORWARD JAVELINS ENGAGE AND THEN DISPLACE, COVERED BY THE FIRES OF JAVELINS POSITIONED IN DEPTH AND LATERALLY.

Figure 4-3. Javelins positioned in depth.

COMBINED ARMS

4-18. Skillful integration of Infantry, Armor, Engineer, and indirect fire assets greatly improve the survivability and lethality of unit Javelins. When employed correctly, the Javelin can be an integral part of the combined arms team.

SECTION II. DEFENSE

This section describes the Javelin in defensive operations, mechanized company defensive employment, defense in depth, and retrograde operations. The principle factors to consider when positioning the Javelin are gunner protection and optimizing the capabilities of the weapon system.

DEFENSIVE OPERATIONS

4-19. The Javelin supports a rifle squad or platoon. In some units, these weapons are organic to the platoon. In units not assigned Javelins, the commander should plan for some form of mutually supporting weapon fires. At times, the platoon may be supported by heavy close combat missile systems, which have a much greater range than the Javelin. During planning, the leader considers the threat, then positions unit weapons accordingly to cover AAs. He also considers the fields of fire, tracking time, and minimum engagement distance of each weapon. The platoon leader selects a primary position and sector of fire for each weapon. He also picks alternate and supplementary positions for them. Each position should allow flank fire and have cover and concealment. The leader should integrate the CLU into his limited visibility security and observation plan. If time permits, the gunner prepares range cards for his primary, alternate, and supplementary positions.

NOTE: See Appendix B for more information.

PERSONNEL DUTIES

4-20. The tasks listed in Table 4-1 must be performed to successfully employ the Javelin in the defense.

Table 4-1. Personnel duties.

TASKS TO BE PERFORMED	AA SECTION --------- SECTION SERGEANT	AA SECTION ------------ TEAM LEADER	GUNNER/ ASSISTANT GUNNER (if assigned)
Integrate Javelin into the platoon tactical plan: • Select general weapons positions. • Assign sectors of fires. • Coordinate mutual support. • Coordinate with adjacent units.	 X X X X		
Reconnoiter for and select tentative Javelin firing positions (primary, alternate, and supplementary) and routes between positions.	X		
Supervise continual preparation and improvement of positions.	X	X	
Coordinate security for the Javelin teams.	X		
Inspect the selection of tentative firing positions. Confirm or make adjustments.	X	X	
Supervise preparation of a standard range card.	X	X	
Control movement of gunners between positions.	X	X	
Issue fire commands to gunners.	X	X	
Coordinate resupply and collection of extra rounds carried in platoon.	X		
Identify enemy AAs.	X		
Prepare fighting position (primary, alternate, supplementary).		X	
Prepare a standard range card.		X	X
Designate target reference points (TRPs).	X		
Prestock Javelin rounds.		X	X
Prepare round for firing.			X
React to fire commands.			X
Engage targets.			X

GUNNER PLACEMENT

4-21. The platoon leader selects the fighting position and assigns the sector of fire. Taking into consideration these simple rules will greatly improve the gunner's survivability.

Natural Cover and Concealment

4-22. The gunner should use the terrain to his advantage for cover and concealment from enemy ground and aerial observation.

Flank or Rear Shots

4-23. It is much more difficult for the enemy to retrace the flight path of a round to its launch site and orient their weapons on the Javelin firing position when the round moves obliquely across the enemy's front.

Mutually Supporting Positions

4-24. Javelins should be placed in mutually supporting positions to ensure continuous coverage of the engagement area (Figure 4-1).

Integrate with Adjacent Units

4-25. Javelin teams need to coordinate with adjacent units to ensure security.

Engage at Maximum Range

4-26. The Javelin's 2,000-meter maximum range makes it difficult for the enemy to engage the Javelin with direct fire. This forces the enemy to deploy earlier than intended. Because of the Javelin's range, it may need to be placed at the flank or rear of the platoon positions.

POSITIONS

4-27. The Javelin gunner prepares three firing positions within the platoon sector of fire, a primary, an alternate, and a secondary position (Figure 4-4).

Primary

4-28. The primary position is one from which a gunner or team can cover the assigned sector of fire. It should have good observation, cover and concealment, and good fields of fire.

Alternate

4-29. The alternate position is one from which a gunner or team can either move to the flank or slightly to the rear of the primary position. The gunner or team must be able to cover the same sector of fire as from the primary position. The gunner moves to the alternate position when the primary position can no longer be occupied. The decision to change positions is made by the leader.

Supplementary

4-30. The supplementary position is one from which a gunner or team covers AAs and any target reference points (TRPs) not covered by the primary and alternate positions. This position is usually close enough to the primary position to share mutual support with other positions. This position should also have good observation, cover and concealment, and good fields of fire.

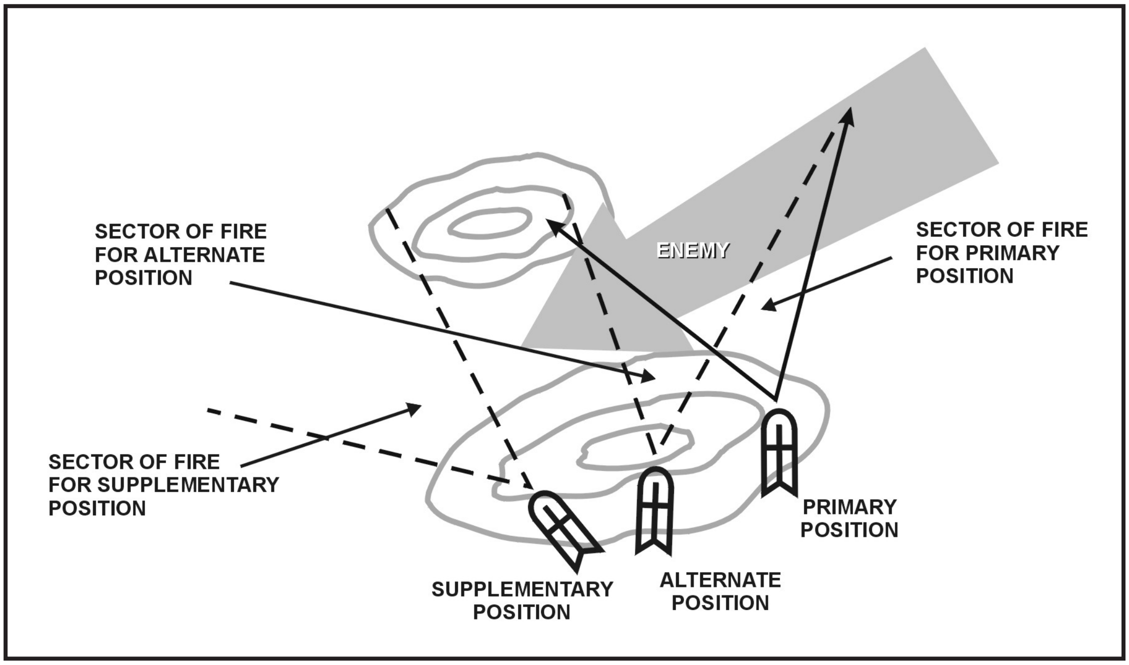

SECTOR OF FIRE FOR ALTERNATE POSITION
ENEMY
SECTOR OF FIRE FOR PRIMARY POSITION
SECTOR OF FIRE FOR SUPPLEMENTARY POSITION
PRIMARY POSITION
SUPPLEMENTARY POSITION
ALTERNATE POSITION

Figure 4-4. Primary, alternate, and supplementary positions.

MECHANIZED COMPANY DEFENSIVE EMPLOYMENT

4-31. Mechanized Infantry companies (Heavy or Light) use the Javelin's range and lethality to complement the firepower of the BFV and Stryker brigade combat team (SBCT). This technique creates a much more effective engagement, especially when the company is fighting without tanks. Without the Javelin, BFV-SBCT equipped Infantry units have difficulty defending when the enemy attacks with both tanks and Infantry fighting vehicles (IFVs). If the commander focuses his BFV fires on the tanks, the IFVs are free to maneuver close enough to engage with their weapons, dismount their Infantry, and begin the assault. If the commander focuses all his fires on the IFVs, he risks letting the enemy tanks get close enough to engage his BFVs. The Javelin gives the mechanized company commander the ability to focus effective fires on both tanks and IFVs throughout his engagement area and to destroy enemy IFVs before they can close to assault range (Figure 4-5).

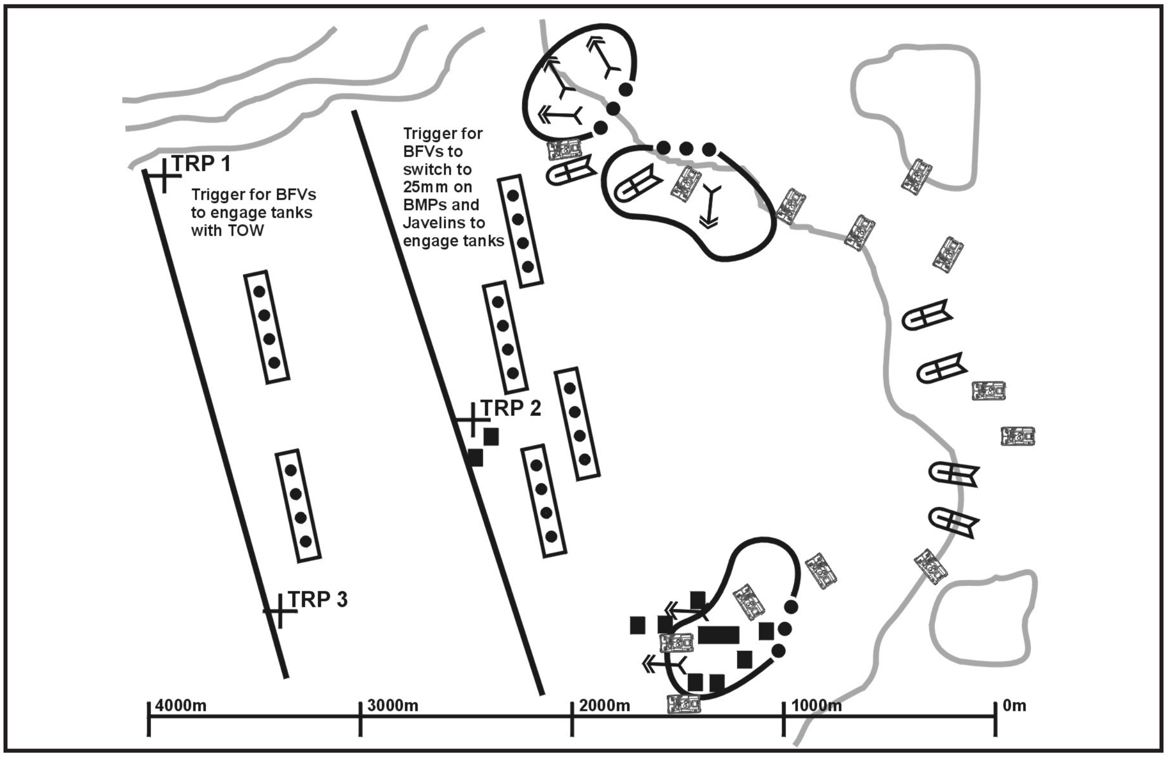

TRP 1
Trigger for BFVs to engage tanks with TOW
Trigger for BFVs to switch to 25mm on BMPs and Javelins to engage tanks
TRP 2
TRP 3
4000m
3000m
2000m
1000m
0m

Figure 4-5. Javelin-equipped mechanized company defense.

DEFENSE IN DEPTH

4-32. In the defense, the Javelin team may participate as part of a screen. The Javelin team supports screen operations by assisting in:

- Maintaining continuous surveillance of AAs using the CLU's night vision capability.
- Detecting enemy units and reporting their direction of movement.
- Destroying the pursuing enemy when forced to withdraw.
- Providing supporting fires to allow screening units to break contact and withdraw.

DELAYS AND WITHDRAWALS

4-33. Delays and withdrawals involve movement away from the enemy. Against an armored enemy, Javelins and similar weapons are often positioned so they can cover the movement of the entire force.

DELAY

4-34. In a delay, the unit trades space for time without becoming decisively engaged, Javelin teams can be directed to set up antiarmor ambushes, to block AAs, and to slow advancing enemy vehicles.

WITHDRAWAL

4-35. In a withdrawal, Javelin teams often overwatch and protect the force as it withdraws.

Withdrawal Under Enemy Pressure

4-36. Enemy pressure makes withdrawing more difficult than it would be otherwise (Figure 4-6). The platoon must employ fire and maneuver to fight its way away from the enemy. To ensure continuous supporting fires, both covering and maneuvering elements must have Javelins.

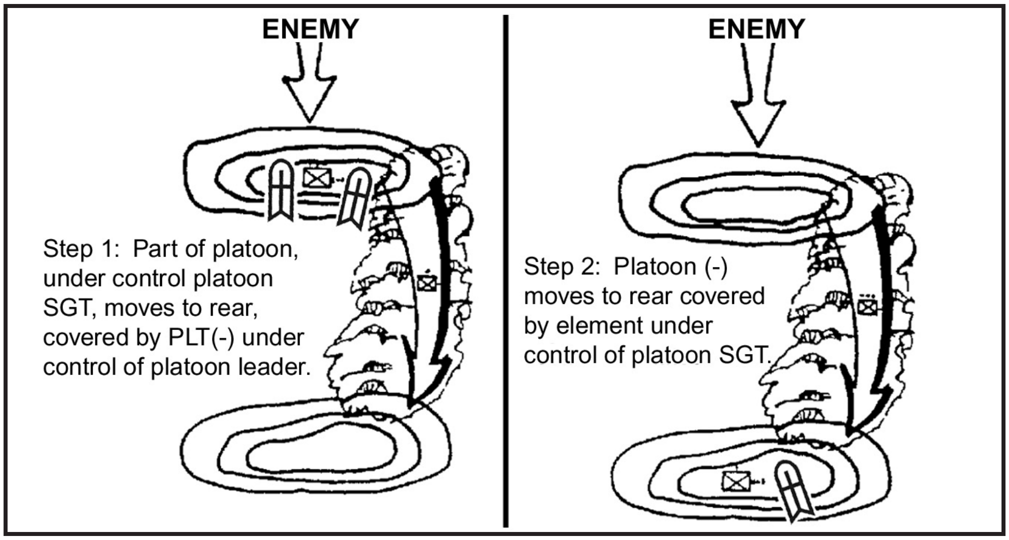

ENEMY
ENEMY
Step 1: Part of platoon, under control platoon SGT, moves to rear, covered by PLT(-) under control of platoon leader.
Step 2: Platoon (-) moves to rear covered by element under control of platoon SGT.

Figure 4-6. Withdrawal under enemy pressure.

Withdrawal Not Under Enemy Pressure

4-37. The company can withdraw with speed, secrecy, and deception (Figure 4-7). Withdrawal is most effective during the hours of darkness or under limited visibility conditions. Withdrawal is usually conducted in mass. When required, the company leaves a security force to cover a withdrawal by deception and maneuver. The weapon section can be split with a portion of the Javelin gunners assigned to the security force and the remainder with the main body.

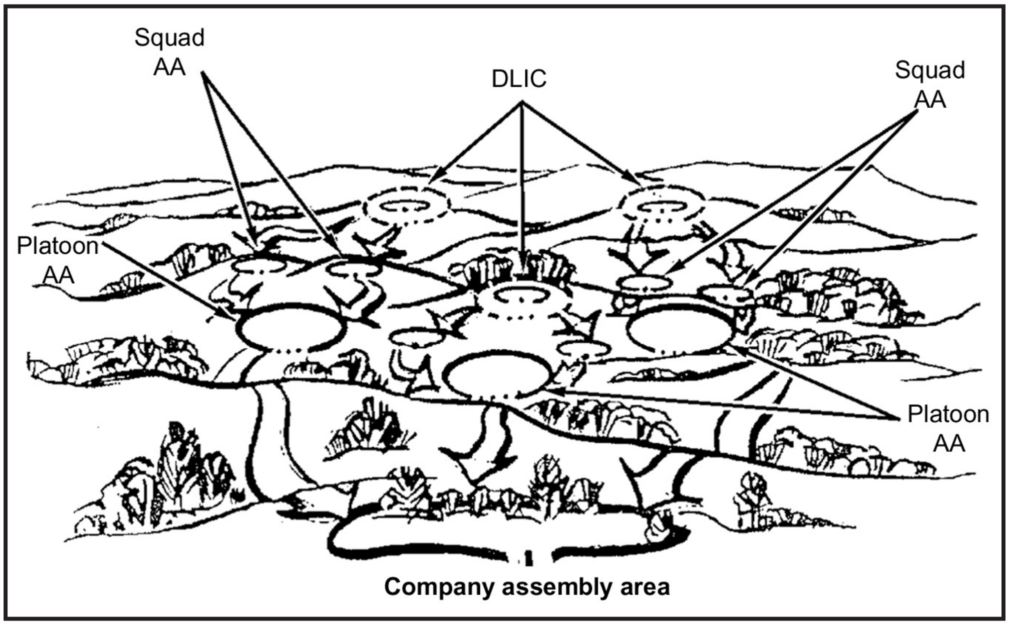

Squad AA
DLIC
Squad AA
Platoon AA
Platoon AA
Company assembly area

Figure 4-7. Withdrawal not under pressure.

SECTION III. FIGHTING POSITIONS

4-38. This section describes the different fighting positions the gunner uses. The gunner may use a hasty fighting position or a deliberate fighting position.

HASTY FIGHTING POSITION

4-39. Hasty positions (Figure 4-8) are prepared when contact is imminent and time available for organization needed to prepare a deliberate fighting position is limited. The gunner should only select a location that affords him (and his assistant gunner, if assigned): cover, concealment, a clear FOV, a clear overhead path for the missile, and a clear backblast area.

4-40. The gunner should dig out an area about one to one and a half M16A2s wide by one and a half M16A2s long and one Kevlar helmet deep. In most areas, it is not necessary to dig a backblast area because the two-stage motor provides a soft launch capability with a small backblast. However, the gunner must check and clear any debris from behind his position. Dirt removed during digging is placed to the front of the position to provide cover for the gunner.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

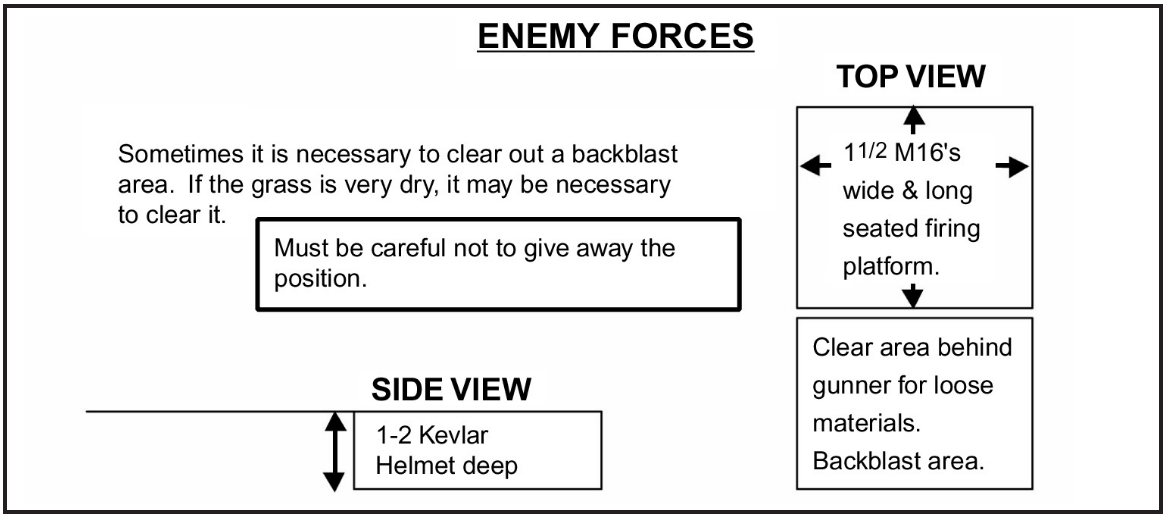

ENEMY FORCES
TOP VIEW
Sometimes it is necessary to clear out a backblast area. If the grass is very dry, it may be necessary to clear it.
Must be careful not to give away the position.
1 1/2 M16's wide & long seated firing platform.
Clear area behind gunner for loose materials. Backblast area.
SIDE VIEW
1-2 Kevlar Helmet deep

Figure 4-8. Hasty fighting position.

4-41. The hasty fighting position is constructed for expansion to afford the gunner and the assistant gunner/ammunition handler, if assigned, cover and concealment. This fighting position is based on the gunner firing from the sitting position, which is the preferred firing position. This position affords the gunner a low silhouette, and a steady and comfortable position while maintaining the ability to engage targets in his sector (Figure 4-9).

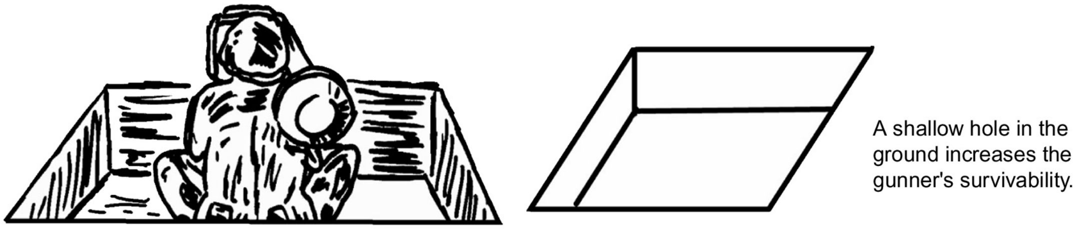

A shallow hole in the ground increases the gunner's survivability.

Figure 4-9. Hasty fighting position.

4-42. The gunner continues to improve the fighting position, as time permits. The position should be expanded to include cover and concealment for the assistant gunner/ammunition handler, if assigned. Once a fighting position begins to expand, then it becomes the firing platform for the deliberate fighting position (Figures 4-10 and 4-11).

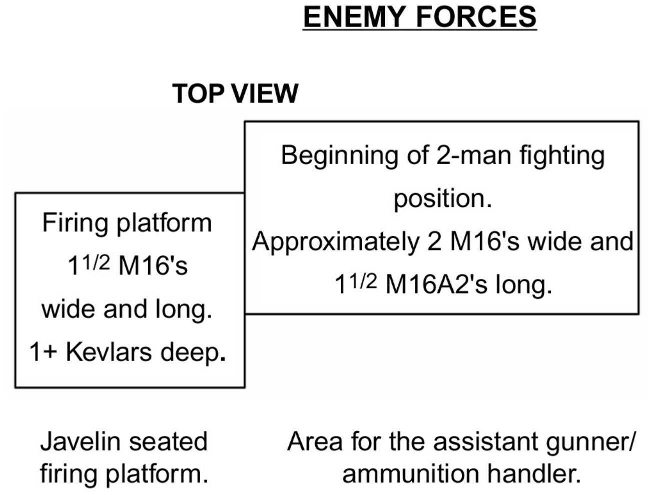

ENEMY FORCES
TOP VIEW
Beginning of 2-man fighting position. Approximately 2 M16's wide and $1^{1/2}$ M16A2's long.
Firing platform $1^{1/2}$ M16's wide and long. 1+ Kevlars deep.
Javelin seated firing platform.
Area for the assistant gunner/ ammunition handler.

Figure 4-10. Improved hasty fighting position.

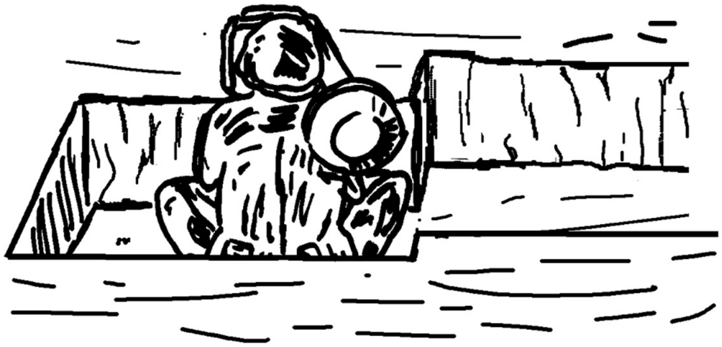


Figure 4-11. Expanded hasty fighting position.

4-43. The gunner now has an expanded hasty fighting position that offers the minimum amount of cover and concealment to the gunner and the assistant gunner/ammunition handler, if assigned. This position is considered the basic fighting position for the Javelin.

DELIBERATE FIGHTING POSITION

4-44. A deliberate fighting position is normally constructed when contact with the enemy is not imminent and time for organization is available. The gunner constructs a two-man fighting position with the Javelin firing platform added to one or both sides, depending on the expected battle situation.

CONSTRUCTING THE FIGHTING POSITION

4-45. To construct a deliberate fighting position, the gunner first traces the outline of the fighting position on the ground, ensuring the outline of the position is facing the center of the squad/platoon's sector of fire. Once the gunner/leaders are satisfied the Javelin line-of-fire is correct, the gunner should—

(1) Check the fields of fire. The gunner must be able to cover the entire sector from that position. If not, he should look for an alternate position and inform the squad leader.

(2) Prepare the Javelin.

(3) Clear fields of fire, both overhead and ground.

(4) Prepare the position. The overall area needed for constructing a Javelin fighting position is about 3 feet (front to rear) by 5 feet (side by side) (Figure 4-12). This includes the space required to construct the front, sides, and back parapets. The depth of the fighting position depends on the height of the shortest Soldier occupying the position. The standing area should be about two M16A2s wide (from side-to-side) and about one and a half M16A2 rifles long (from front to rear) (Figure 4-12).

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

- Dig the primary (left side) Javelin seated firing platform. He should dig down about one Kevlar helmet deep, one and a half M16A2s wide, and one M16A2 long. All dirt removed should be used to build the parapets to the front and flanks of the position.
- Dig the standing area of the deliberate fighting position wider than the standard two-man fighting position making room for the Javelin round and the gunner's equipment.
- Decide if a secondary sitting firing platform is needed. If needed, digs the position, using the dirt to build the right side parapet.
- Improve the position by adding overhead cover. The overhead cover should not restrict the gunner from firing the Javelin, and should not completely cover the firing platform. This allows the missile to exit the LTA without obstruction.
- Improve the position by adding a storage/protective area. The size of this area depends on the space needed for equipment.
- Camouflage the front of the position. If possible, moves out in front of the fighting position about 35 meters to see if the fighting position can be seen. The position must blend into the background.

(5) Continue improvements as long as the position is occupied.

- Check the camouflage and replace them as necessary.
- Position camouflage nets, if used, so they do not hang in the backblast area. If any portion of the net is in the backblast area, it can reflect launch overpressure into the position, damage the net, and could collapse the position when the missile is launched.

NOTE: Camouflage maintenance is a continuous process.

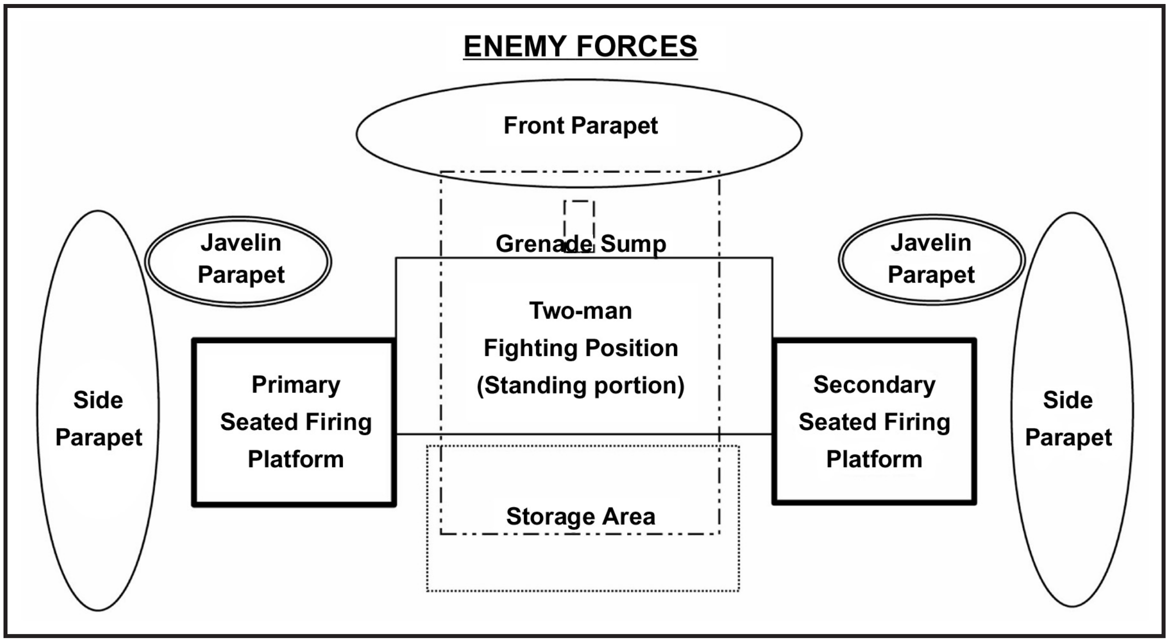

ENEMY FORCES
Front Parapet
Javelin Parapet
Grenade Sump
Javelin Parapet
Two-man Fighting Position (Standing portion)
Side Parapet
Primary Seated Firing Platform
Secondary Seated Firing Platform
Side Parapet
Storage Area

Figure 4-12. Deliberate fighting position.

LEGEND

☐ Javelin seated firing platform (1-1/2 M16A2s wide by 1 M16A2s long).
▭ Two-man fighting position (2 M16A2s wide by 1-1/2 M16A2s long).
⬭ Parapet (minimum of 18 inches between you and the enemy and as high as necessary).
⬚ Overhead cover (1-1/2 M16A2s wide by 1-1/2 to 2 M16A2s long) capable of supporting at least 18 inches of dirt.
⬚ Storage area (depends on amount of equipment to be stored, to include extra Javelin rounds).
⬚ Grenade sump (1 entrenching tool in diameter and the length of the entrenching tool deep).
▭ Backblast berm is about 1 Kevlar helmet thick and 18 inches high. The berm deflects the hot gases and debris up and out. This reduces the amount of clearing required.
▣ Javelin parapet, sand bags if available, should be used.

VIEWS

4-46. The three views of Javelin fighting positions are illustrated in Figure 4-13, but refer to the legend for Figure 4-12.

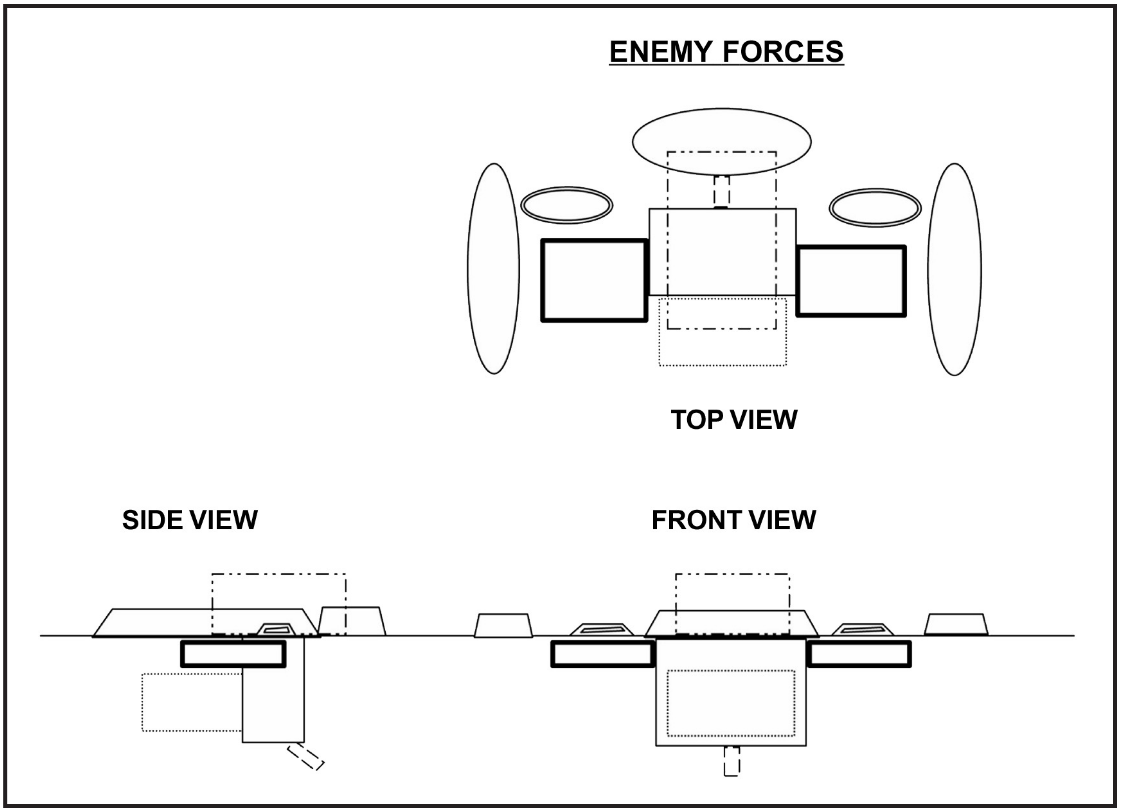


Figure 4-13. Completed deliberate fighting position.

FORTIFIED JAVELIN FIGHTING POSITION

4-47. In a defensive position, with the help of the engineers and an abundant supply of Class IV materials, it is possible to construct a bunker-style fighting position. This position requires a lot of time and material.

Front View

4-48. The front of the Javelin defensive fighting position (Figures 4-14 and 4-15) provides considerable protection from small arms and indirect fire. However, the gunner is limited in his ability to engage targets.

4-49. When this type position is constructed, it is imperative to examine the front of the position and consider how well the position blends into the background.

4-50. When using vegetation, replace it when it begins to die. How long the vegetation remains green depends on the temperature. After the gunner has scanned the sector for any signs of the enemy, the assistant gunner/ammunition handler, if assigned, approaches the front of the position to check its concealment and makes the required improvements, then returns. The gunner continues surveillance until the assistant gunner/ammunition handler, if assigned, has returned to his position.

NOTE: Continuous movement to the front of the fighting position can damage natural camouflage, making the position stand-out. Limit movement around the position, and use more than one approach to the position to keep from creating paths to and from the position.

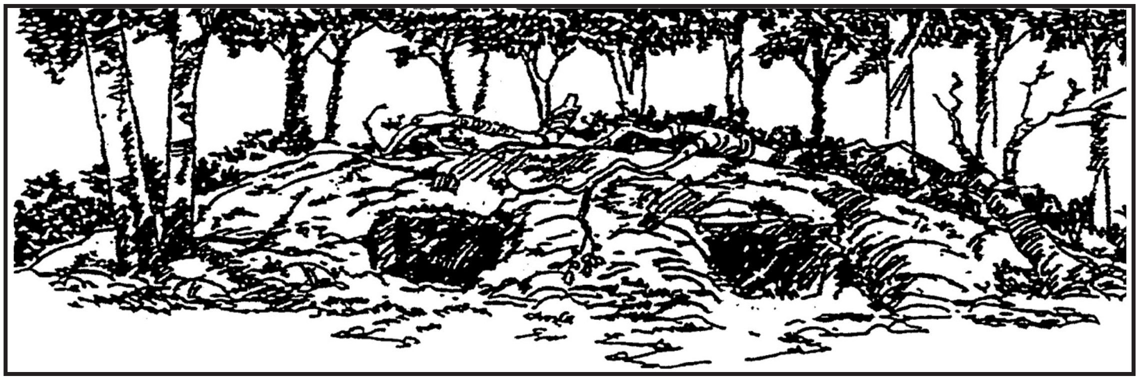


Figure 4-14. Sketch of the front view of a Javelin defensive fighting position.

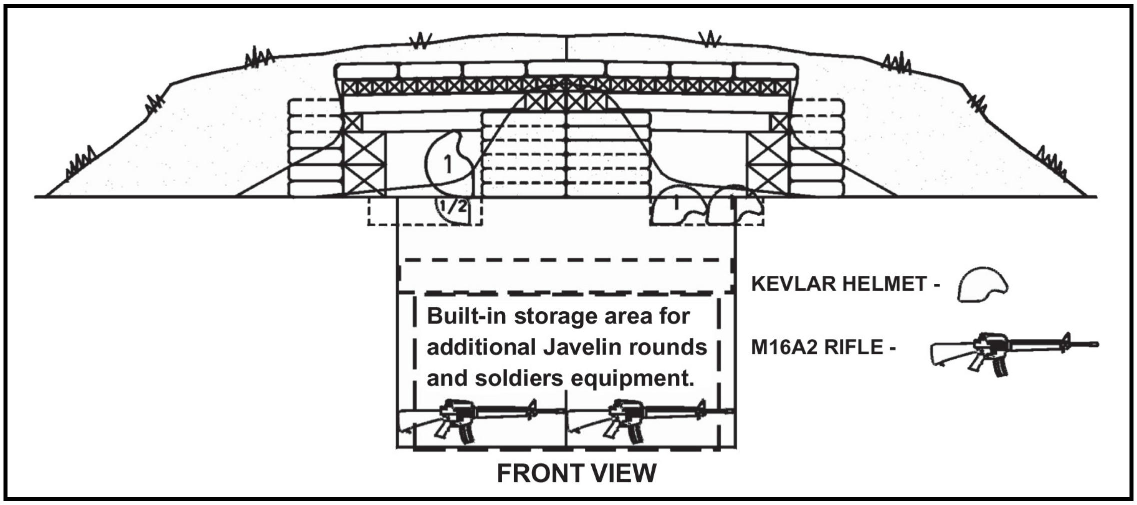

1
1/2
KEVLAR HELMET -
M16A2 RIFLE -
Built-in storage area for additional Javelin rounds and soldiers equipment.
FRONT VIEW

Figure 4-15. Front view of a Javelin defensive fighting position.

Side View

4-51. Figure 4-16 shows the side view of the Javelin defensive fighting position.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

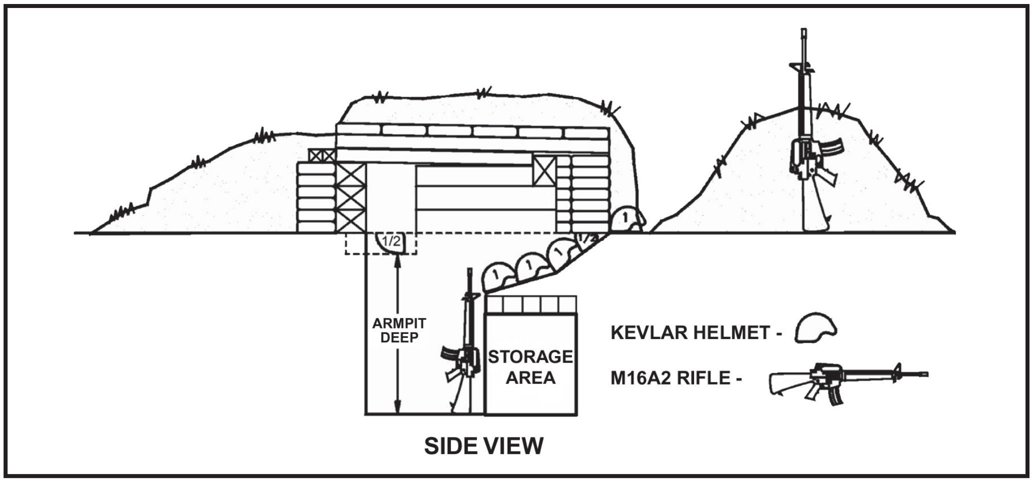

1/2
1
ARMPIT DEEP
STORAGE AREA
KEVLAR HELMET -
M16A2 RIFLE -
SIDE VIEW

Figure 4-16. Side view of a Javelin defensive fighting position.

Top View

4-52. Figure 4-17 shows the top view of a Javelin defensive fighting position.

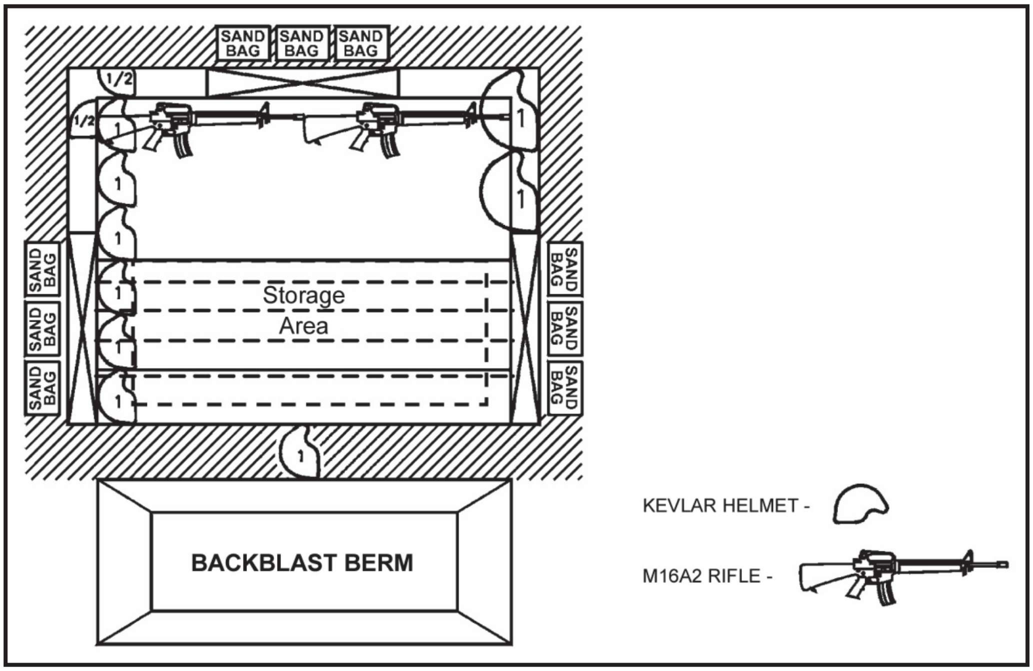

SAND BAG
1/2
1
Storage Area
BACKBLAST BERM
KEVLAR HELMET -
M16A2 RIFLE -

Figure 4-17. Top view of a Javelin defensive fighting position.

NOTE: If assigned an M4-series weapon, add 7 inches to the dimensions on the position.

SECTION IV. OTHER TACTICAL OPERATIONS

4-53. This section describes how the Javelin contributes to offensive operations and the antiarmor ambush role. During stability and support operations, Javelins are not used in their typical roles.

OFFENSIVE OPERATIONS

4-54. The Javelin contributes to offensive operations (Figure 4-18) by providing long-range fires that destroy enemy armor and protecting the force from counterattacks. In the absence of armored targets, the Javelin can be used against enemy fortifications and for locating and disrupting enemy sniper fire. The Javelin is normally used in a support-by-fire role during offensive operations. The primary consideration for such employment is the availability of fields of fire and the threat. Javelin teams can also provide overwatch for unit movement.

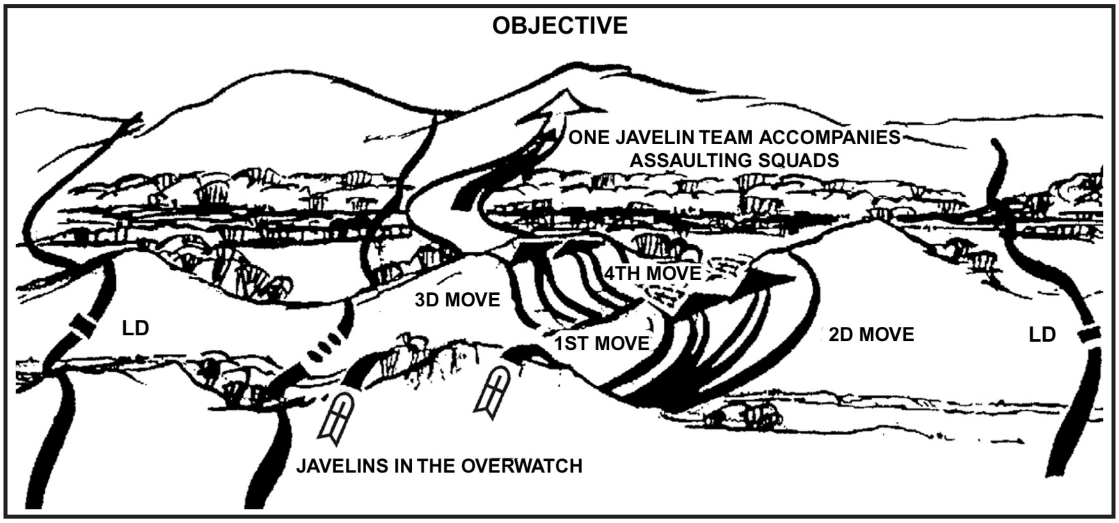

OBJECTIVE
ONE JAVELIN TEAM ACCOMPANIES ASSAULTING SQUADS
4TH MOVE
3D MOVE
LD
1ST MOVE
2D MOVE
LD
JAVELINS IN THE OVERWATCH

Figure 4-18. Javelin supporting offensive operations.

ANTIARMOR AMBUSH ROLE

4-55. Antiarmor ambushes are usually conducted to destroy small groups of armored vehicles, force the enemy to move more slowly and cautiously, or force the enemy into a choke point. Any unit conducting an antiarmor ambush can use Javelins for this purpose. The Javelin has a slow rate of fire, so other weapon systems must be prepared to engage the vehicles while the Javelin gunners attach the CLU to new rounds. The Javelin's 2,000-meter range allows flexibility in choosing ambush positions. In addition to fires into the kill zones, the Javelin can be employed in a security role to guard high-speed AAs, to slow or stop enemy reinforcements, or to destroy vehicles attempting to flee the kill zone (Figure 4-19).

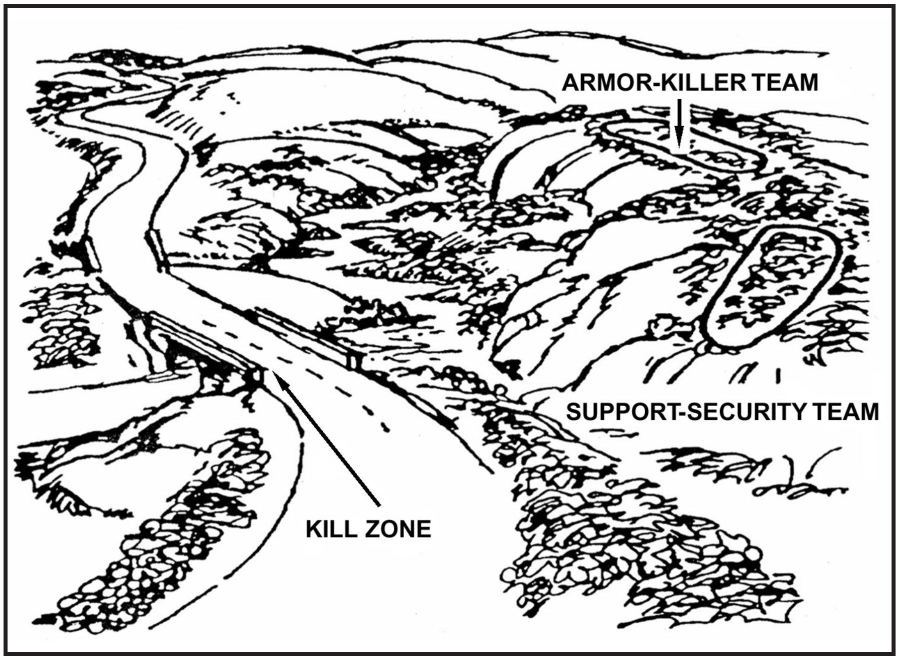


Figure 4-19. Antiarmor ambush.

STABILITY AND SUPPORT OPERATIONS

4-56. During stability operations, Javelin gunners may be used against an armored threat if one exists. If there is no armored threat, the Javelin gunner can expect to provide a surveillance capability. The NVS is especially useful during periods of limited visibility. In the case of 24-hour operated roadblocks, Javelin gunners provide protection against vehicles that attempt to run the roadblock. To be effective in this task, the gunner needs to be able to position himself where he has an unimpeded view of the approaches to the roadblock. The gunner must clearly understand the rules of engagement (ROE) to know when he is authorized to engage targets, which may be at minimum range. The observation capability of the Javelin's sight may be useful during support operations, but it is not likely that a missile will ever be fired.

URBAN COMBAT

4-57. Although the Javelin is primarily used to defeat main battle tanks and other combat vehicles, it has a moderate capability against bunkers, buildings, and other fortified targets commonly found during combat in built-up areas. Javelin teams provide overwatching fires during the attack of a built-up area. Within built-up areas, they are best employed along major thoroughfares and from the upper floors of buildings or roofs to attain long-range fields of fire. The minimum engagement distance limits firing opportunities in the confines of densely built-up areas, and the Javelin may not be the weapon of choice in the urban environment where there are additional considerations including: fires (caused by both friendly and enemy) may cause target acquisition and lock-on problems; clutter on the battlefield may cause lock-on problems; and, line-of-sight communications may be limited by the structures.

OBSTACLES

4-58. The Javelin’s unique flight path forces the gunner to check missile flight path before engaging targets. The urban environment has overhead obstacles such as street signs, light poles, and wires, which could impede the missile’s flight path.

ENGAGEMENT CONSIDERATIONS

4-59. The Javelin's three distinct engagement considerations are: engagement distance, crossover, and time.

Engagement Distance

4-60. The Javelin missile has a minimum engagement distance (150 meters in the attack mode and 65 meters in the direct attack mode), which limits its use in built-up areas. Few areas in the inner city permit the gunner to fire much beyond the minimum arming distance. The gunner is usually limited to firing down streets, rail lines, parks, or plazas. The Javelin can effectively fire from upper level stories or roofs of buildings into other buildings as long as the gunner has a "clear" missile flight path.

Crossover

4-61. Sometimes the seeker will not be able to distinguish between the background and the target because the two have the same temperature (crossover).

Time

4-62. When a gunner comes across a target of opportunity, he may not be able to take advantage of it. The cooldown time of the NVS is 2.5 to 3.5 minutes. Seeker cooldown takes about 10 seconds. Once the BCU is activated, the gunner has a maximum of 4 minutes to engage the target before the BCU is spent. Vehicles crossing the street or moving between buildings (flank shot) are exposed for about 10 to 15 seconds, meaning the gunner may not have enough time to lock-on to the target and fire.

BACKBLAST

4-63. The soft launch capability enables the gunner to fire from inside buildings because there is little overpressure or flying debris. Anyone in the enclosure should wear a helmet, protective vest, ballistic eye protection, and hearing protection.

WEAPON PENETRATION

4-64. The dual charge warhead penetrates typical urban targets. The direct attack mode is selected when engaging targets in a building. Enemy positions or bunkers in the open closer than 150 meters are engaged using the direct attack mode. Positions in the open farther than 150 meters are engaged using either the top or direct attack mode depending on the situation.

SECTION V. TARGET ENGAGEMENT TECHNIQUES

Target acquisition is essential for a gunner to be effective on the battlefield. Target acquisition is a four-step process: target detection, target classification, target recognition, and target identification. Target acquisition begins with detection; the gunner uses his senses in conjunction with the CLU to detect targets. Using the CLU to aid in the detection, classification, recognition and identification of the enemy target only enhances the commander's usage as a valuable tool for the unit. The gunner learns to use different fields of view in scanning for targets.

TARGET DETECTION

4-65. The gunner should listen for the sounds that will alert him to the enemy's presence, it may not pinpoint the exact location but it will alert him. The gunner can see vehicles moving by dust trails. The gunner's best method of detection is with his eyes. He can also use binoculars, his scope, his NVS, and even the CLU to aid him in detecting targets. When scanning his sector of fire, the gunner should look for the most likely areas a vehicle may be positioned or approaching from. Look for dust or vehicle exhaust. Look for enemy vehicle movements along high-speed AAs. As a vehicle moves over a terrain feature it may cause what is known as a "flash" this is the thermal signature may be visible for a fraction of a second after the vehicle has moved out of sight. Look for unnatural shapes and shadows.

During the daytime, light often reflects off equipment and in the dark, the enemy may not practice good light discipline making them observable by the naked eye allowing the gunner to detect targets quickly and begin the target engagement process. The gunner determines target engageability by changing the fields of view.

TARGET IMAGES

4-66. There are some differences in the way a target appears in each FOV (Figure 4-20):

- Day FOV: full-color visible light image, 4x magnification of target.
- WFOV: black-and-green IR image, 4x magnification of target.
- NFOV: black-and-green IR image, 9x magnification of target.
- Seeker FOV: black-and-green IR image, 9x magnification of target.

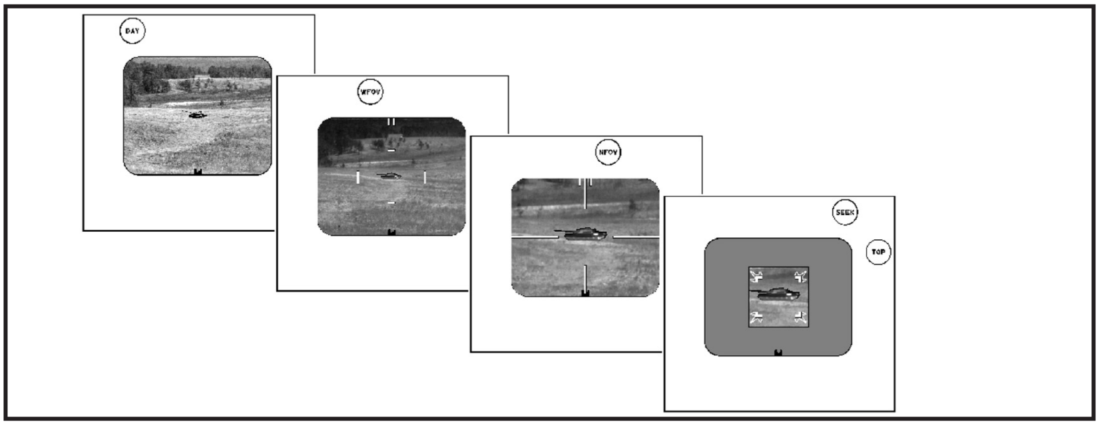


Figure 4-20. Fields of view.

FIELDS OF VIEW

4-67. The day FOV is used during daylight hours to conduct surveillance and target detection. The NVS has two fields of view, WFOV and NFOV that present a black-and-green image of the terrain and targets. The missile has a seeker FOV and is used for target engagement and is available to the gunner once the seeker has been activated. Cold areas appear dark green or black, and hot areas light green. The gunner adjusts the contrast and brightness controls and the focus to better locate enemy targets.

Wide Field-of-View

4-68. WFOV is used as the primary scanning FOV for surveillance and target detection.

Narrow Field-of-View

4-69. NFOV is used for target classification, recognition and identification. This FOV has a limited use for target detection and is not used for scanning because of its small area.

Seeker Field-of-View

4-70. Seeker FOV is the view that the missile has of the target. Is used to lock the track gates onto the target.

SCAN FOR TARGETS

4-71. The gunner must scan his sector of fire or area of surveillance at all times for the enemy. The scanning techniques that help to detect targets quickly are rapid scan, slow scan, and detailed search. The gunner observes the following procedures in all three techniques to scan for targets effectively (Figure 4-21). The gunner—

- Scans the entire sector of fire or area of surveillance using WFOV of the CLU.
- Scans in a consistent pattern, slowly and evenly.
- Pays special attention to those positions in which a target would most likely appear, for example, AAs.
- Identifies the location of objects, such as trees, roads, buildings, and any man-made IR signatures.

Rapid Scan

4-72. The rapid scan method is used to detect obvious signs of enemy activity. This type of scan is used when first occupying a fighting position. (Figure 4-23). The gunner—

- Divides the target area into sections. Uses TRPs or easily recognizable terrain features to divide the area.
- Adjusts the brightness of the CLU display so that the hot spots (bright green when viewed through the CLU display) stand out in the CLU display.
- Starts from the gunner's position, scans out to either the left or the right to the farthest point of the gunner's sector and back across the sector to the other side.
- Stops and uses the detailed search technique, if the gunner suspects he has spotted a target during the rapid scan.

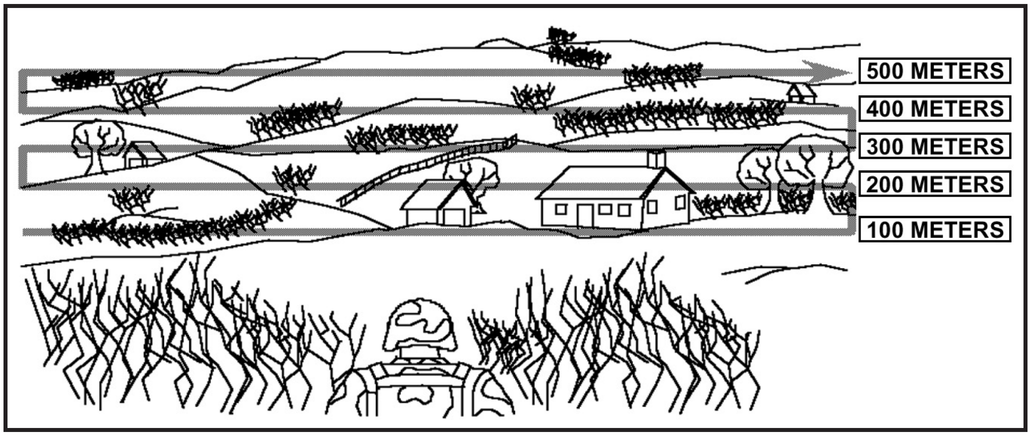


Figure 4-21. Slow/rapid scan.

Slow Scan

4-73. If there are no targets detected during the rapid scan, the gunner conducts a slow scan of the sector (Figure 4-21). The gunner—

- Starts from the gunner's position and begins a slow scan of the sector from left to right in short intervals 50 to 100 meters deep, until a scan of the sector is completely covered.
- Conducts a more detailed search if a target is detected.

Detailed Search

4-74. The detailed search is used when targets are either detected, or other techniques have been used and it has resulted in no enemy activity found. The gunner uses the NFOV to search specific areas of the sector. If a target is detected, the gunner uses the NFOV to further recognize, classify and identify the target. (Figure 4-22) The gunner—

- Concentrates on specific areas that are more likely for targets to be hiding or likely AAs.
- Looks for signs that the enemy may have been in the area by looking for tracks and any other signs of enemy activity.

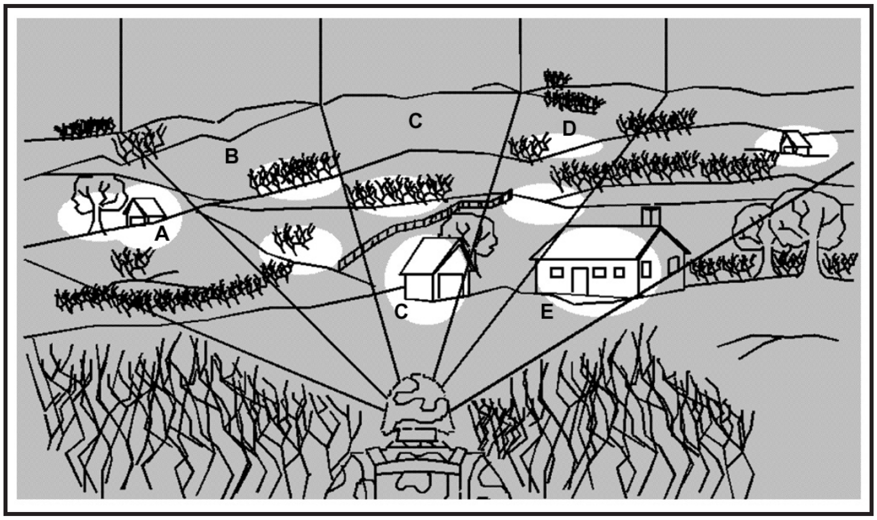


Figure 4-22. Detailed search.

Moving Targets

4-75. Moving targets are easier to spot when scanning a sector because movement catches the eye's attention. Moving vehicles also leave signatures that are easily detected by the NVS of the CLU. The following considerations will help gunners detect moving targets:

- Track vehicles leave a distinct pattern on the ground caused by the friction from the tracks in contact with the ground.
- Exhaust plumes are easily seen when the vehicles are moving through low lying areas.
- An IR flash can be seen immediately following a vehicle that moves behind cover.

Stationary Targets

4-76. These targets are more difficult to detect than moving targets due to camouflage or its cold status. Targets that have been sitting for long periods of time may appear to blend in with the remainder of the surroundings. However, tanks and other vehicles are started periodically to ensure they remain combat ready. This procedure heats up the vehicle, exhaust, and engine areas.

Hot Stationary Targets

4-77. Tanks, armored personnel carriers (APCs), and other vehicles either remain running for long periods of time or are started to keep their batteries from running low and to keep their electronics operational. These targets have a hot signature when compared to its surroundings. The gunner easily detects these targets when using the CLU (Figure 4-23).

Suspension System

4-78. Tracks, wheels and road wheels heat up during movement. It provides a hotter signature than the hull and makes detection easier.

Engine Compartment

4-79. Once stopped, the vehicle continues to give off a hot signature for several hours. The engine takes longer to cool off than the remainder of the vehicle.

Exhaust

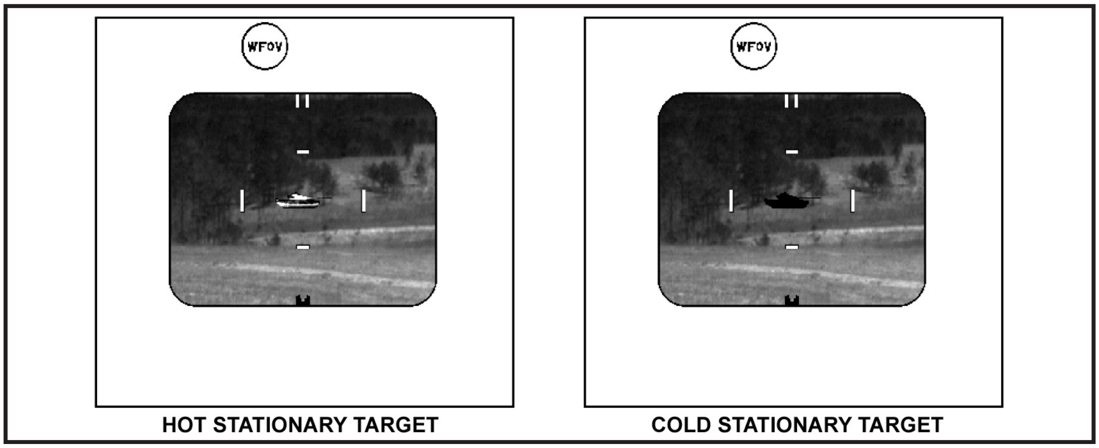
4-80. Vehicles are started periodically to charge its engines. The vehicle’s exhaust takes time to cool down after being operated.

Gun Tube

4-81. If the vehicle has been involved in firing, its gun tube gives off a heat signature that will aid in classification.

Cold Stationary Targets

4-82. After a vehicle has been sitting for a long period of time, without the engine or electronics being operated, it appears as darker green or black against the surrounding area. When using the CLU in the night vision mode (WFOV or NFOV), the target is detected based on its appearance in relation to the surrounding objects or ΔT.



HOT STATIONARY TARGET

COLD STATIONARY TARGET

Figure 4-23. Stationary targets.

TARGET CLASSIFICATION

4-83. Once a target is detected, the gunner must classify the target as either a wheeled or tracked vehicle (Figure 4-24). Different parts of the vehicle give off heat signatures making the classification of a vehicle easier. When viewed through the NVS (WFOV or NFOV), a vehicle's wheels or suspension system quickly heats up.

WHEELED VEHICLES

4-84. The hubs of wheeled vehicles heat up along with the tires, giving it a distinct heat signature. Based on the vehicles configuration of axles, there may be two or more distinctive round heat signatures just below the hull or body. The engine compartments are normally located at the front of the vehicle. Some wheeled vehicles may or may not have gun tubes; if it does, some may be small and harder to spot, while those with larger gun tubes when fired heats up and makes classification of the vehicle easier.

TRACKED VEHICLES

4-85. The suspension system has road wheels that heat up during movement, usually five to seven road wheels based on the type of vehicle. The engine compartment is usually located in the rear on tanks and the front on APCs. These signatures are usually hotter for a longer period of time than the remainder of the vehicle. Track vehicles, like wheeled vehicles, may or may not have gun tubes; if it does, some may be small and harder to spot, while those with larger gun tubes when fired heats up and makes classification of the vehicle easier.

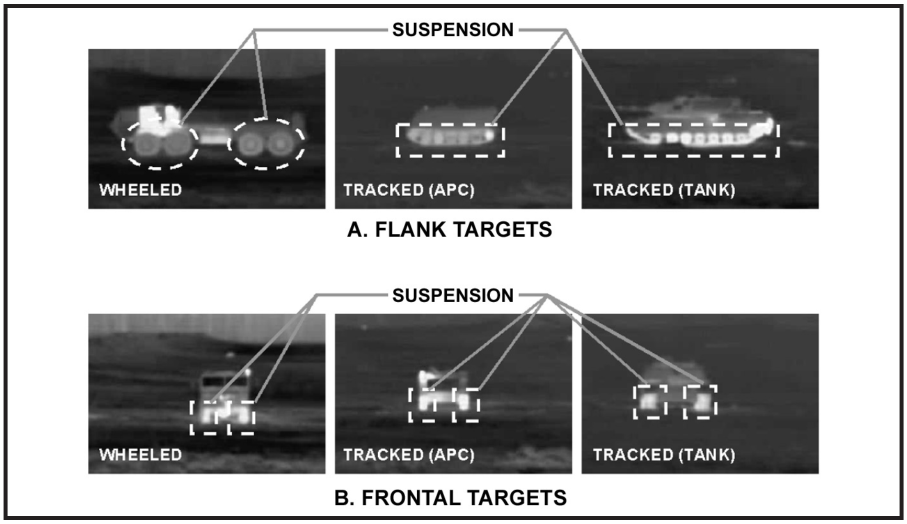

SUSPENSION
WHEELED
TRACKED (APC)
TRACKED (TANK)
A. FLANK TARGETS
SUSPENSION
WHEELED
TRACKED (APC)
TRACKED (TANK)
B. FRONTAL TARGETS

Figure 4-24. Target classification features.

TARGET RECOGNITION

4-86. After a gunner classifies a target as a wheeled or track vehicle, the gunner then determines whether a target is a tank or an APC. Some of the same techniques used to classify a vehicle are used to recognize the vehicle.

TANKS

4-87. The characteristics of a tank make this vehicle stand out from others. The large gun tube, the five to seven road wheels, and the engine compartment being in the rear of the vehicle, all make this easily recognizable as a tank. (Figure 4-25)

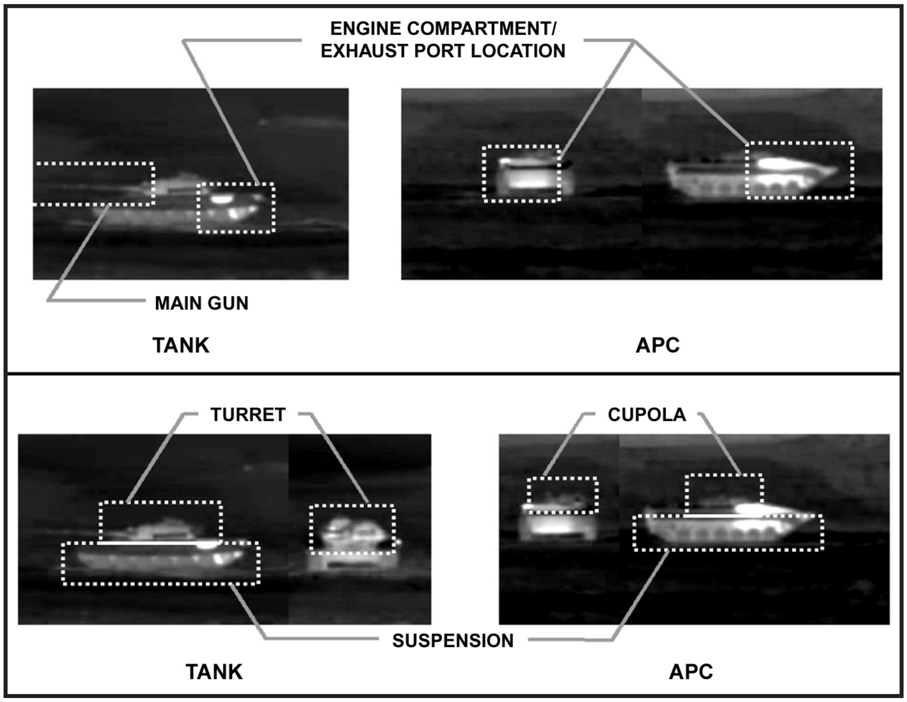

ENGINE COMPARTMENT/
EXHAUST PORT LOCATION
MAIN GUN
TANK
APC
TURRET
CUPOLA
SUSPENSION
TANK
APC

Figure 4-25. Target classification.

ARMORED PERSONNEL CARRIERS

4-88. Based on the configuration of an APC, it may be wheeled or tracked. The enemy configures the APC differently based on its use however; there are some common characteristics for them. The engine compartment is located in the front of the vehicle; they may or may not have a turret, and may or may not have a gun tube.

TANKS OR ARMORED PERSONNEL CARRIERS

4-89. The target classification features for tanks and APCs are listed in Table 4-2.

Table 4-2. Target classification features.

SIGNATURE	TANK	APC
Engine Compartment	In rear	In front
Exhaust Ports	In rear	In front or side
Main Gun	Long and thick	Short and thin
Turret	Yes and large	Some and usually small
Cupola	New Tanks	No
	Old Tanks	Yes
Size/Shape		Large and sloping

TARGET IDENTIFICATION

4-90. Once the gunner has detected, classified and recognized, he may have enough information to engage the target, but the final step in target acquisition is identification. The enemy may have common armored vehicles as our allies and the gunner must be sure of his target. The use of the CLU provides the gunner with a thermal image of a target; therefore the gunner must have a clear understanding of thermal vehicle signatures as well as daylight images. Training aids available to the units come in different forms, from compact disk read-only memory (CD-ROM) and graphic training aids (GTA) to actual photographs. These tools are used prepare the gunner to correctly identify enemy and friendly vehicles.

4-91. The Night Vision and Electronic Sensors Directorate, PM–FLIR, can be contacted at ROV-V@nvl.army.mil for assistance in vehicle identification. The Recognition of Combat–Vehicles (ROC-V) CD-ROM is available from this directorate.

4-92. GTA 17-2-13 provides the gunner with line drawings and pictures of friendly and enemy vehicles. These are available through the local training support center (TSC).

TARGET ENGAGEMENT

4-93. There are several factors inherit to Javelin that the gunner must consider before engaging a potential target. They are—

- Time/space factors.
- Track gate solution.
- Multiple targets.
- Rapid target engagement techniques.

TIME/SPACE FACTORS

4-94. The gunner must take into consideration the factors that decrease the probability of hitting the target. He must consider—

- The time it takes for NVS cooldown (2.5 to 3.5 seconds).
- The time it takes for seeker activation (10 to 14 seconds).
- The time it takes to adjust track gates, lock-on, and fire.
- The time it takes for the missile to fly the distance to the target (2,000 meters in 14 seconds).

- The speed of the vehicle.
- The location of possible cover that the vehicle may be headed towards and may reach before missile impact.
- Any obstructions in the flight path of the missile.

NOTE: Keep in mind that there is a time delay of about 10 seconds between the time of seeker activation and when the seeker FOV comes on the CLU display.

TRACK GATE SOLUTION (SEEKER LOCK-ON)

4-95. To achieve a seeker lock-on target, the gunner must ensure he has a good image of the target by adjusting the focus, contrast, and brightness while in the WFOV or NFOV. Once the seeker FOV is available, the gunner keeps the target in the center of the FOV and begins his track gate adjustments.

Tanks and Turretless Targets

4-96. To ensure a good seeker lock-on, keep the target's center of mass (the tank's hull but not the gun barrel) centered in the track gates and adjust the track gates as close to the tank's edges as possible (Figure 4-26). To increase the probability of a hit, place the track gates around the hull only. Do not include the turret on flank targets.

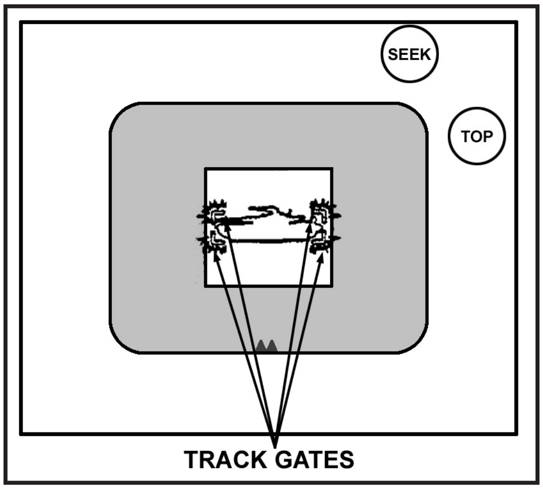


Figure 4-26. Position track gates on target.

Stationary Targets

4-97. The lock quality for stationary targets is good when the track gates surround the edges of the target. If they are too large or too small, break lock, readjusts the track gates around the target, and relock on the target. Continue this procedure until lock-on is achieved.

Hull-Down Targets

4-98. When engaging hull-down vehicles at the maximum distance (2,000 meters), the CLU is limited by track gate adjustments based on the size of the target. Adjust the track gates to acquire only the visible portions of the target.

Hovering Helicopter

4-99. To ensure an effective engagement, select the direct attack mode only.

Frontal Target

4-100. Adjust the track gates so that they surround only the nose of the fuselage (Figure 4-27). Any appendages (such as armaments, wings, rotor, and so forth) should be ignored.

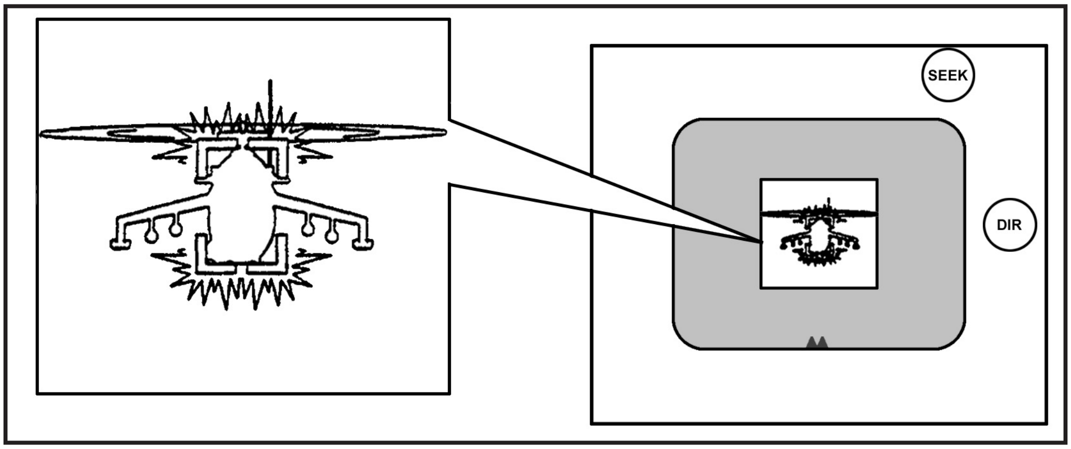


Figure 4-27. Track gate adjustment for helicopters—front.

Flank Target

4-101. Adjust the track gates to surround the passenger/engine compartment or main body (for those helicopters without a passenger compartment) (Figure 4-28). Any appendages—such as the cockpit, tail boom, rotor, and so forth—are ignored.

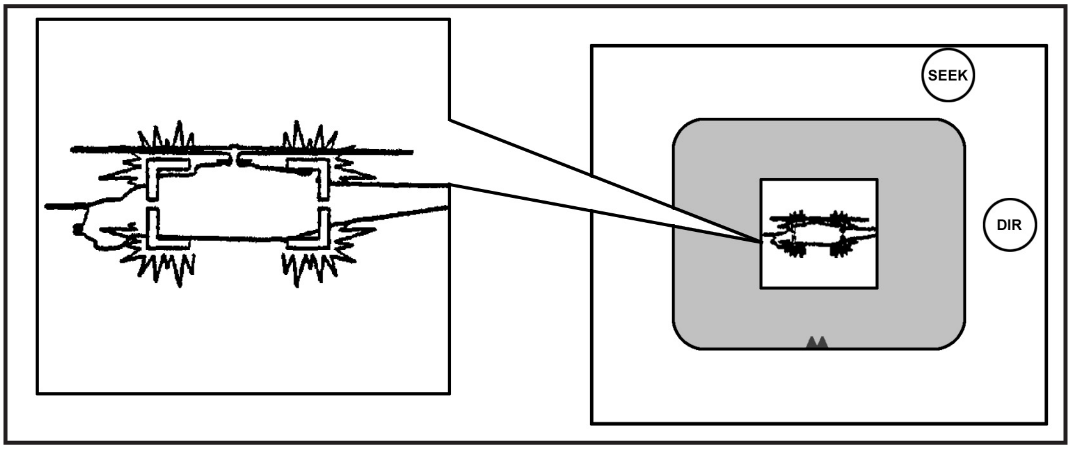


Figure 4-28. Track gate adjustment for helicopters—flank.

Bunker

4-102. Track gate adjustment for a bunker involves the perceived size of the bunker's firing port. This adjustment depends on the range to the bunker.

- Place the track gates around the internal opening of the firing port (Figure 4-29). Select the direct attack mode when engaging this type of target.

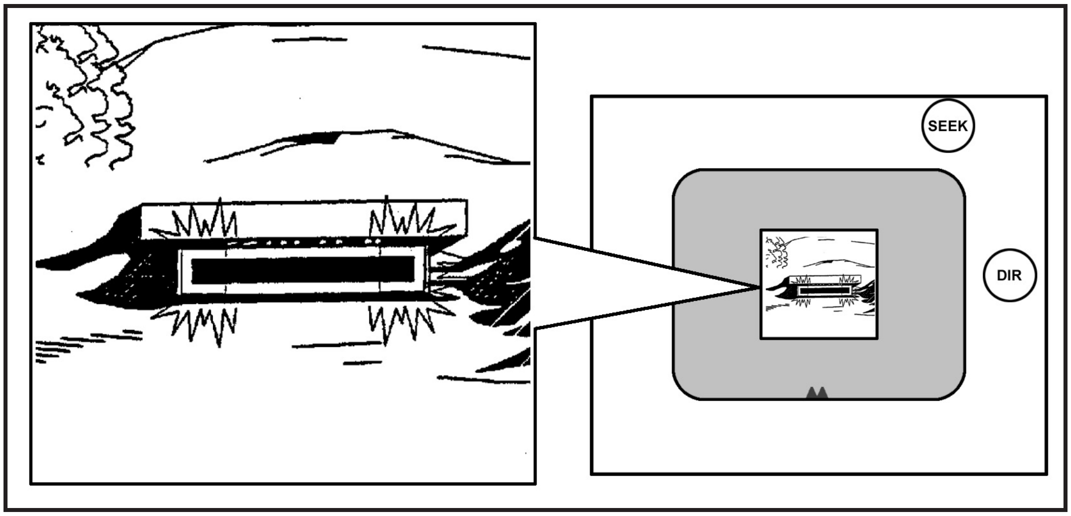


Figure 4-29. Track gate adjustment for bunker.

- If the bunker is at a range far enough away that the firing ports cannot be seen, adjust the gates so that they surround the port frame. Select the direct attack mode when engaging this type of target.

Obscured Targets

4-103. Attempt to acquire the entire target when engaging targets obscured by dust, smoke, or IR clutter.

MULTIPLE TARGETS

4-104. The biggest difference between a single-target engagement and a multiple-target engagement is removing the CLU from the empty LTA, connecting the CLU to a new round, and engaging the remaining targets. The sequence of events is—

(1) Prepare the Javelin for firing.
(2) Assume a good firing position.
(3) Determine target engageability.
(4) Activate the seeker. (Squeeze and hold the seeker until the BCU pop is heard.)
(5) Change attack mode, if necessary.
(6) Adjust track gates.
(7) Lock-on target.
(8) Check crosshairs and track gates.
(9) Launch the missile.
(10) After missile launch, release the fire and seeker triggers.
(11) Remove the CLU from the empty LTA. Place the empty LTA outside the backblast area.
(12) Connect the CLU to a new round.
(13) Repeat until all the targets are engaged and destroyed.

RAPID ENGAGEMENT TECHNIQUES (DAY MODE ONLY)

4-105. This technique is used to engage a target rapidly when time is critical and time available for the NVS to cool down. Standard engagement procedures are used except for powering up the CLU in the DAY mode and activating the seeker before assuming a firing position. This action starts the 10-second seeker cooldown. By the time it takes to assume a good firing position, the Javelin should be in seeker FOV. The sequence of events for a rapid engagement is—

(1) Prepare the Javelin for firing.
   - Connect the CLU to a round.
   - Power up the CLU in the DAY position.
   - Activate the seeker. (Hold the seeker trigger and listen for the BCU pop before releasing the trigger.)
   - Remove the forward end cap.

(2) Assume a firing position. Observe the CLU display and ensure the following:
   - Green DAY, SEEK, and TOP indicators are lit (usually 10 to 15 seconds).
   - Seeker FOV and flashing track gates are present.
   - Change the attack mode, if necessary.

NOTE: The seeker FOV has a very limited area of coverage. Look over the CLU to locate the target, and aim the CLU in the direction of the target and attempt to acquire the target. If the target cannot be located, change the SEL switch to day FOV to locate the target, and then go back to the seeker FOV.

(3) Adjust the track gates.
(4) Lock-on the target.
(5) Check crosshairs and track gates.
(6) Launch the missile.
(7) Perform battle damage assessment (BDA) or displace.

FIRE PLAN

4-106. The Javelin is part of the direct fire plan and is used in conjunction with other weapon systems to cover an engagement area. The platoon leader should use the fire plan to ensure constant coverage by key weapon systems. The fire plan also includes units to the flanks and how their fires interlock to provide mutual support.

FIRE CONTROL

4-107. Well-planned and executed fire control measures are critical to the effectiveness of Javelin fires. Javelin positions should not be jeopardized by premature fires in which either the range is excessive or the target is not in position to ensure a high probability of kill. Proper fire control ensures that Javelins engage targets at optimum times and with only the best placed Javelin in relation to the target. Uncontrolled firing decreases the effectiveness of the unit's overall weapon capabilities.

METHODS

4-108. The primary control methods used to control the fire of one or more Javelins include sectors of fire, TRPs, engagement priorities, fire patterns, and fire commands.

Sector of Fire

4-109. A sector of fire refers to an area limited by boundaries and assigned to a unit or weapon to cover by fire (Figure 4-30). The gunner or unit assigned a sector of fire may fire only within that sector. Leaders should make sure sectors overlap to cover all areas and so that the Javelin gunners do not hesitate when enemy vehicles come into range. The gunner should record the left and right limit on his range card.

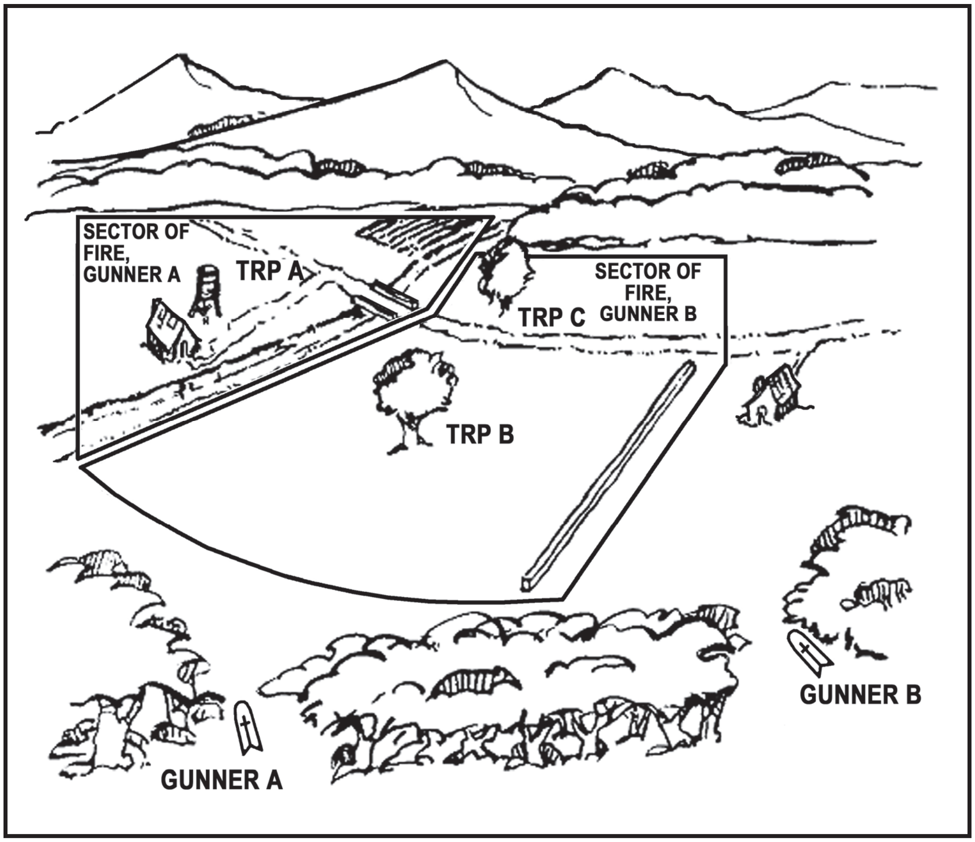


Figure 4-30. Sector of fire.

Target Reference Point

4-110. A TRP identifies an easily recognizable, natural or man-made point on the ground. The TRP is used as a reference point for locating and controlling fires. They are normally referenced by two letters, followed by four numbers (assigned by a higher headquarters). TRPs are also used for shifting fires. The gunner must record the location of TRPs on his range card (see Appendix B).

Engagement Priorities

4-111. Engagement priority means the order in which Javelins engage the various types of vehicles in an enemy formation. The commander designates the engagement priority for each of his units. Table 4-3 is an example list of engagement priority.

Table 4-3. Engagement priority.

1.	Command and control vehicles
2.	Tanks/APCs
3.	Antiaircraft vehicles

Fire Patterns

4-112. Fire patterns describe the relationship between Javelins and their targets. Firing patterns help leaders control the gunners. These patterns also give gunners specific targets to focus on. Two basic patterns include cross-fire and depth-fire. Leaders should not fixate on one, but should remain flexible and change the pattern as needed. Within the unit's sector, the leader could use both patterns at the same time.

Crossfire

4-113. Leaders should use crossfire patterns with targets dispersed laterally or when obstructions prevent the Javelin from firing to the front. Gunners must stagger their crossfire. That is, when the first missile hits, only then should other systems fire.

Flanking Targets

4-114. With flanking targets, leaders should have each gunner engage the target that is diagonal to his position.

Frontal Targets

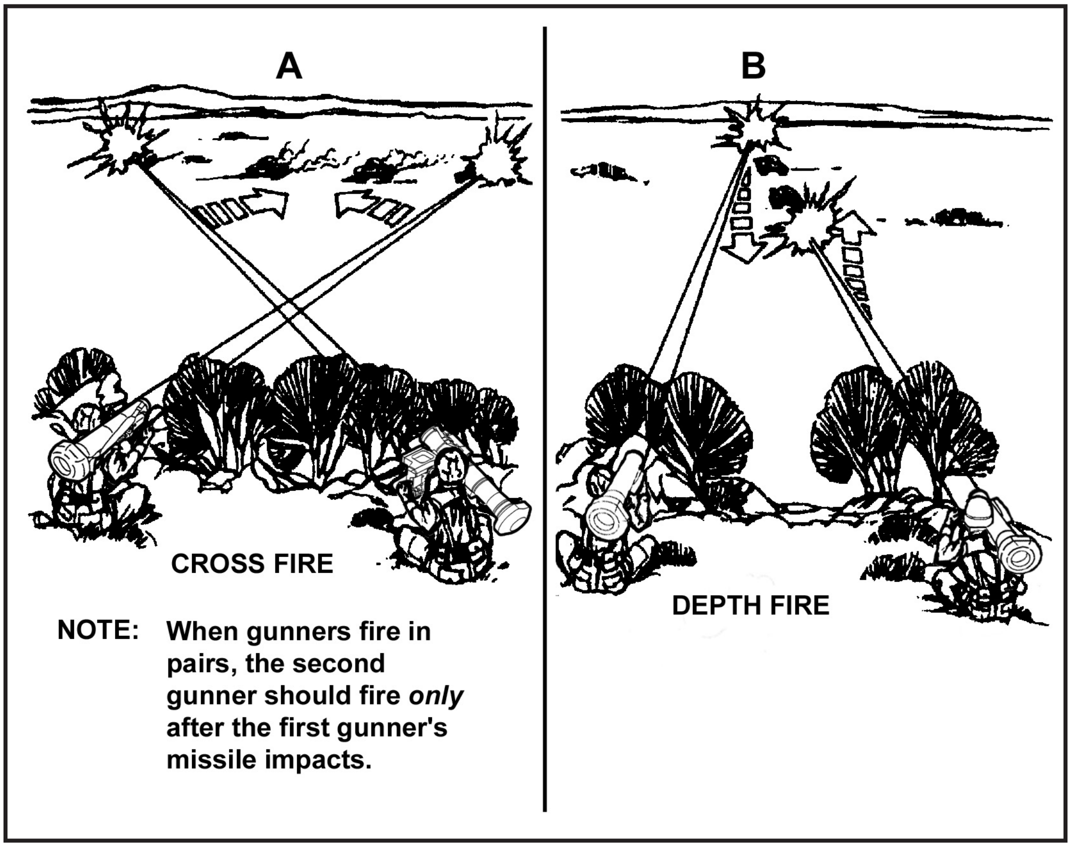
4-115. With a frontal target, that is, a target moving straight at the Javelin, leaders should use cross–fire. This helps prevent detection.

Follow-Up

4-116. As Javelin gunners destroy their targets, leaders should have them shift their fire to the center of the enemy formation (Figure 4-31A).

Depth Fire

4-117. Leaders should use depth fire when targets are exposed in depth. Have Javelins on one side engage the nearest targets, while Javelins on the other side engage the farthest targets. The gunners can then shift fire toward the center of the formation. This procedure should be specified by unit standing operating procedures (SOPs) or in the section leader's order (Figure 4-31B).



NOTE: When gunners fire in pairs, the second gunner should fire *only* after the first gunner's missile impacts.

Figure 4-31. Fire patterns.

Fire Commands

4-118. The leader uses the fire commands to control the gunner's rate of fire, time of fire, and point of fire. When distance dictates radio delivery of fire commands, the gunner divides his concentration between listening to the radio and firing the Javelin. His assistant, if he has one, listens to the radio and relays the radio commands (Table 4-4).

Table 4-4. Fire commands and examples.

ELEMENT	DEFINITION	EXAMPLE
Alert	Warns the gunners of a fire mission.	"Enemy in sector, prepare to fire."
Target Description/ Location	Briefly describes the target location relative to a TRP or the gunner.	"BMP, 200 meters right of TRP 1."
Method of Engagement	Provides instructions for engaging a formation—fire cross or depth fire, fire front to rear, fire left to right or right to left, and so forth.	"Fire from rear to center." "Fire from front to center."
Execution	Gives the command to fire	"Team Alpha, fire." "Team Bravo, stand by."
Cease Fire	Gunner gives BDA and continues the engagement.	"One tank (APC) destroyed," and continues engagement.

EMERGENCY FIRE SIGNALS

4-119. Radio communications may be lost. In such cases, control of fire will be difficult at best. Use of sectors of fire and alternate signals with pyrotechnics will often be the best and most rapid method available to control the fire of Javelin gunners. Units should establish SOPs and practice communications procedures.

RANGE CARDS

4-120. In some situations, such as when moving from position to position to cover the movement of an advancing force or during retrograde operations, preparing and using range cards may not work. In that case, TRPs offer the best way to control the distribution of fire. If time and circumstances permit, gunners prepare range cards for primary, alternate, and supplementary positions. These cards help the gunner engage targets successfully.

Chapter 5

BLOCK 1 IMPROVEMENTS

Specific Block 1 changes enhance the CLU's optics. These improvements shorten both the target acquisition surveillance time and the operator timeline, thereby allowing for earlier target engagement and a potential improvement in survivability.

INTRODUCTION

5-1. This chapter reflects Block 1 improvements to the CLU and associated weapon training components. While some information contained in Chapter 1 and Chapter 2 is repeated in this chapter, additional information is provided, changes are added, and the order in which this information is provided will not be the same as in previous chapters. Javelin CLU software and hardware changes are covered later in the chapter; other Block 1 system changes (Figure 5-1) include—

- Replacing the BST with a 12x afocal lens that simulates the improved CLU.
- Adding a video port connector to provide video output capability of the CLU images to the FTT instructor station.
- Adding a new FTT instructor station cable and upgrading the software to support video output from the improved CLU.
- Modifying the MSR to work with the improved CLU.

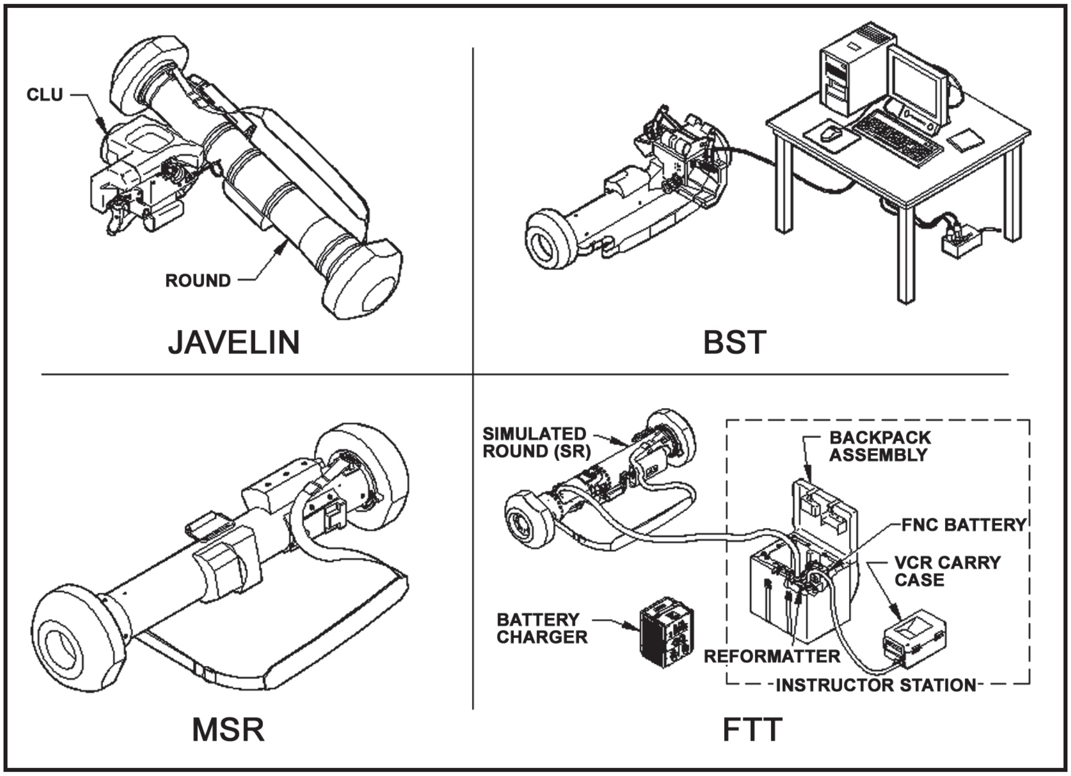

CLU
ROUND
JAVELIN
BST
SIMULATED ROUND (SR)
BACKPACK ASSEMBLY
FNC BATTERY
VCR CARRY CASE
BATTERY CHARGER
REFORMATTER
INSTRUCTOR STATION
MSR
FTT

Figure 5-1. Javelin weapon system.

WEAPON SYSTEM (BLOCK 1)

5-2. The Javelin weapon system (Block 1) consists of the improved M98A2 CLU, the FGM-148 round, and a suite of training devices—the M78 BST, the M82 FTT, and the MSR.

COMMAND LAUNCH UNIT

5-3. The CLU (Figure 5-2) is the reusable component of the Javelin. It is equipped with a daysight, NVS, and controls and indicators used during Javelin operation. The CLU is issued with a carry bag, which provides space to carry a CLU, a technical manual, a BA-5590/U lithium battery, and a lens cleaning kit (Figure 5-3).

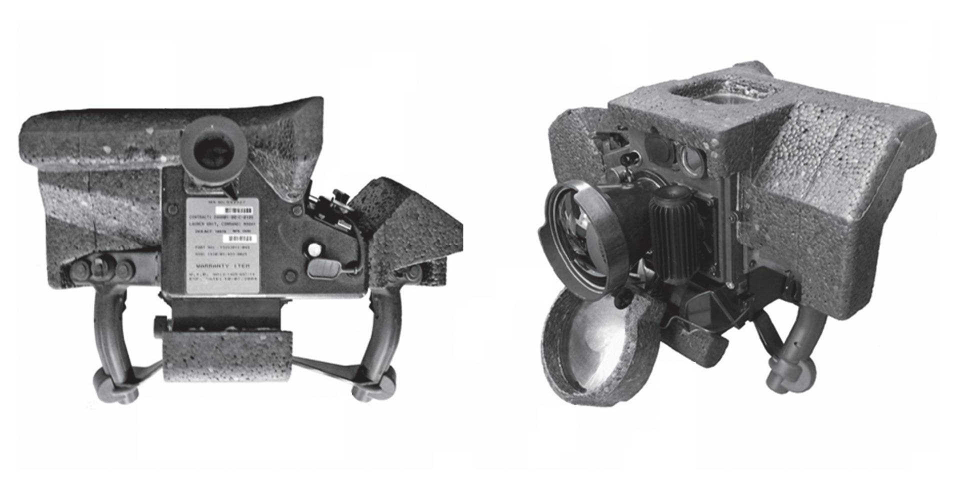


Figure 5-2. Javelin command launch unit.

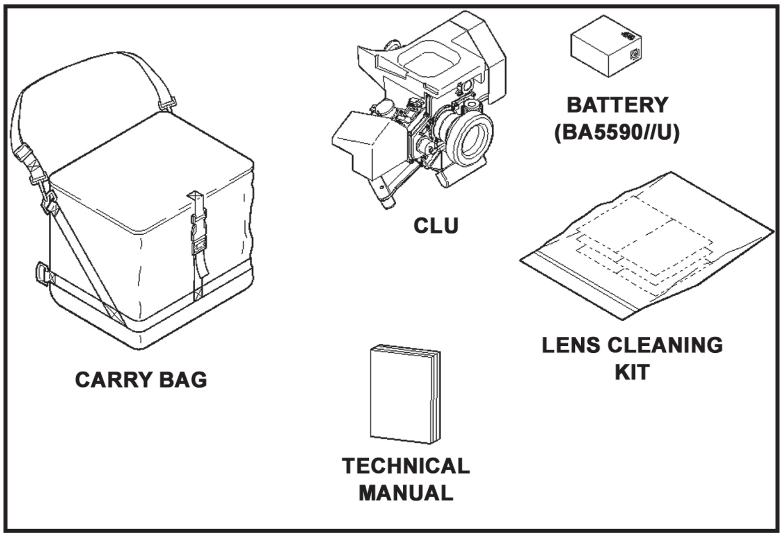


Figure 5-3. Javelin command launch unit and accessories.

Daysight

5-4. The daysight allows the gunner to conduct surveillance operations on days with clear weather.

Night Vision Sight

5-5. The NVS allows the gunner to operate during the day and in low visibility conditions.

Controls

5-6. The controls allow the gunner to process all Javelin operations.

Indicators

5-7. The indicators provide the gunner with updates on operational changes within the Javelin.

ROUND

5-8. The round consists of an LTA, a BCU, and a missile.

Launch Tube Assembly

5-9. The LTA serves as the launch platform and carrying container for the missile.

Battery Coolant Unit

5-10. The BCU powers the missile and cools the seeker while the missile is in the LTA.

Missile

5-11. The missile (Figure 5-4) provides the means to engage and destroy tanks, APCs, and other vehicles. It is composed of five sections:

- Guidance section.
- Warhead section.
- Mid-body section.
- Propulsion section.
- Control actuator section.

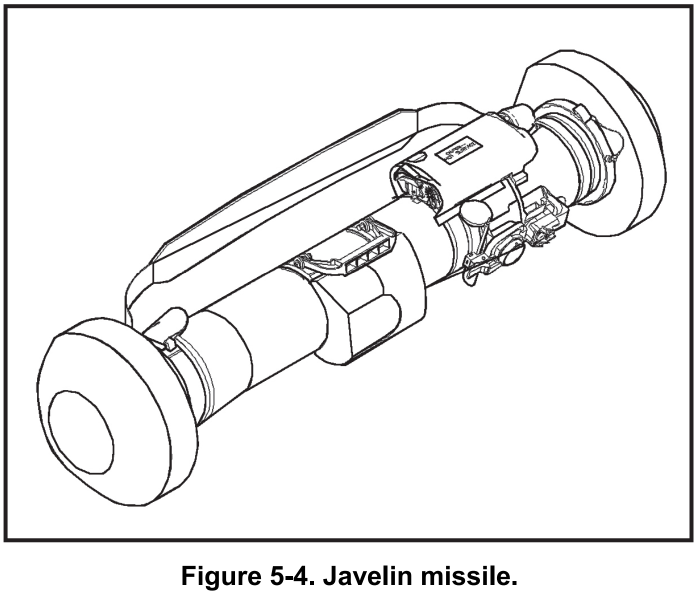


Figure 5-4. Javelin missile.

TRAINING DEVICES

5-12. The three training devices associated with the Javelin system—the BST, the FTT, and the MSR—provide unit leaders with the means to train new Javelin gunners and maintain unit Javelin gunner proficiency without using live ammunition.

Basic Skills Trainer

5-13. The BST (Figure 5-5) is an indoor training device consisting of a Soldier station and an instructor station.

- The Soldier station consists of a simulated CLU and an MSR, connected to the instructor station by a W1 cable.
- The instructor station consists of a desktop computer with a mouse, a keyboard, a monitor, a surge suppressor, and power cables that connect the instructor station to the Soldier station.

5-14. BST training exercises are created using visible and IR images of real terrain and three-dimensional target models that simulate target movement. To initiate gunner training, the instructor selects an exercise using the instructor station monitor. As training continues, the gunner views the exercises through the simulated CLU and reacts to the situations presented, and the instructor views the progress on the instructor station monitor.

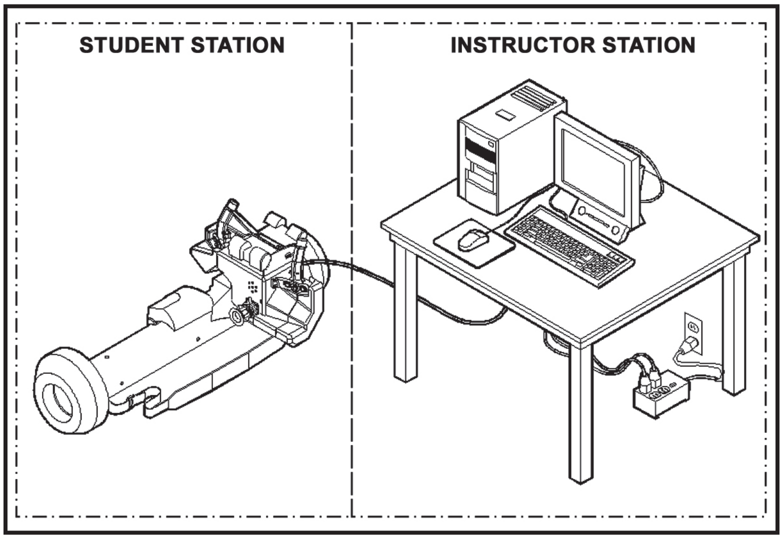


Figure 5-5. Basic skills trainer.

Field Tactical Trainer

5-15. The FTT (Figure 5-6) is an outdoor training device consisting of a simulated round (equipped with MILES for FTXs) and an instructor station. The FTT uses the CLU as an integral component.

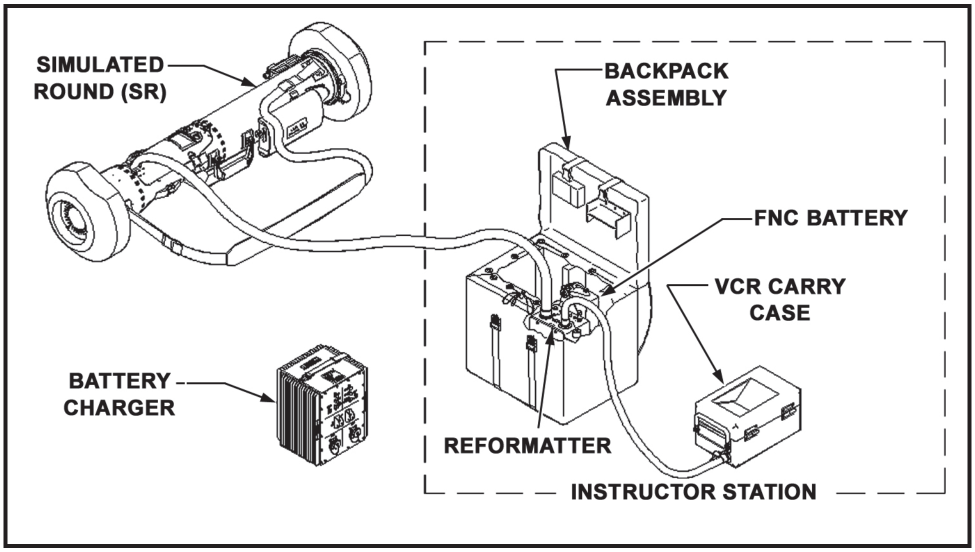

SIMULATED ROUND (SR)
BACKPACK ASSEMBLY
FNC BATTERY
VCR CARRY CASE
BATTERY CHARGER
REFORMATTER
INSTRUCTOR STATION

Figure 5-6. Field tactical trainer.

Missile Simulation Round

5-16. The MSR (Figure 5-7) is a simulated Javelin round that contains no instruments or circuitry, but is designed to simulate the weight and balance of an actual round of ammunition. It is used to train gunners on the techniques used to maintain, handle, and carry the round, and is also used with the BST to allow the gunner to feel the weight and center of gravity when connected to the simulated CLU.

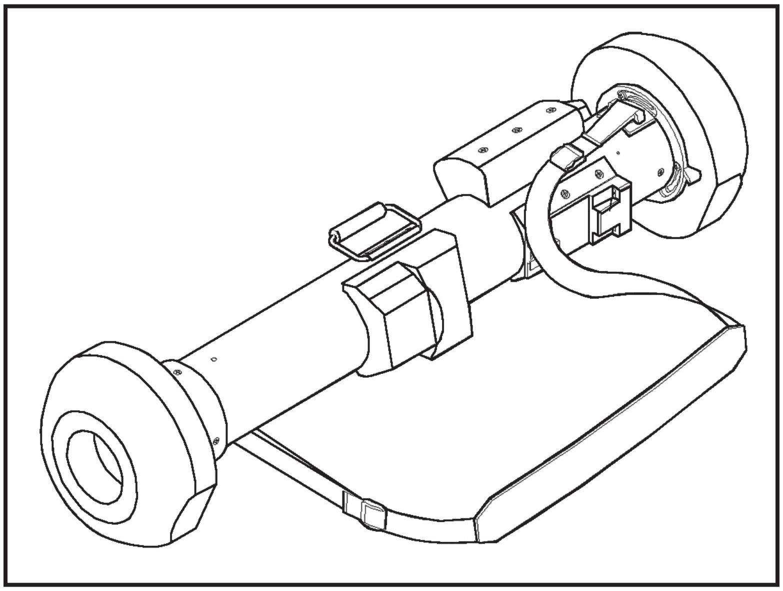


Figure 5-7. Missile simulation round.

EQUIPMENT DATA AND DESCRIPTION

5-17. Tables 5-1 through 5-3 list the Javelin's capabilities and features, the CLU's physical characteristics, and the round's physical characteristics. Although some information found in the following tables is similar to that found in Chapter 1, the information helps in showing where improvements were made to the Javelin.

Table 5-1. Javelin missile and weapon system capabilities and features.

Type of System	Fire and forget	
Crew	One- to three-Soldier teams based on TOE	
Missile Mode	Top attack (default)	
	Direct attack	
Minimum Effective Range	Top attack mode	150 m
	Direct attack mode	65 m
Maximum Effective Range	Direct attack and top attack modes	2,500 m
Backblast Area	Primary danger zone	Extends out 25 m at a 60-degree (cone-shaped) angle
	Caution zone	Extends the cone-shaped area out to 100 m
NOTE: See Figure 1-5 and Appendix A for safety factors.		
Propulsion– Two-Stage Motor	Launch motor ejects the missile about 15 ft from the LTA	
	Flight motor propels the missile to the target	
Firing From Inside Enclosures	Minimum room length	15 ft
	Minimum room width	12 ft
	Minimum room height	7 ft

Table 5-2. Physical characteristics of the command launch unit.

Dimensions and Weight	CLU with Battery, Carry Bag, and Cleaning Kit	
	Weight	14.99 lb (6.80 kg)
	Length	19.29 in (49.00 cm)
	Height	13.00 in (33.02 cm)
	Width	16.50 in (41.91 cm)
	Carry Bag Only	
	Width	0.60 lb (0.27 kg)
	CLU with Carry Bag and Cleaning Kit	
	Weight	12.77 lb (5.79 kg)
Sights	Daysight	
	Magnification	4x
	FOV	6.4° x 4.8°
	NVS	
	WFOV--magnification	4x
	WFOV	6.11° x4.58°
	NFOV--magnification	12x
	NFOV	2° x 1.5° (approximately)
Battery	Type	*Lithium sulfur dioxide battery, BA-5590/U (Non-rechargeable)
		**Nickel metal hydride battery, BB-390A/U rechargeable (training use only)
	Number required	1
	National stock number (NSN)	*6135-01-036-3495
		** 6140-01-490-4317
	Weight	2.22 lb (1.01 kg)
	Life (NIGHT mode)	4.0 hr below 120°F (49°C)
		3.0 hr between 50°F to 120°F (10°C to 49°C)
		1.0 hr between -20°F to 50°F (-49°C to 10°C)
		0.5 hr above 120°F (49°C)

Table 5-3. Physical characteristics of the round.

Round, Complete LTA With Missile BCU Installed	Weight and Dimensions	
	Weight	34.16 lb (15.50 kg)
	Length	47.60 in (120.90 cm)
	Diameter	
	Across end caps	11.75 in (29.85 cm)
	Across LTA	5.515 in (14.00 cm)
Missile Only	Weight and Diameter	
	Weight	22.328 lb (10.128 kg)
	Length	42.626 in (108.27 cm)
	Diameter	5.000 in (12.70 cm)
	Seeker FOV	
	FOV magnification	9x
	FOV	1° x 1°
BCU	Weight and Diameter	
	Weight	2.91 lb (1.32 kg)
	Length	8.160 in (20.726 cm)
	Width	4.627 in (11.752 cm)
	Battery Section	
	Type	Lithium iron disulfide (non-rechargeable)
	Life Expectant	4 min minimum
	Coolant Gas Section	
	Type	Argon

COMMAND LAUNCH UNIT

5-18. The enhanced operating software improves CLU performance by replacing the crossbar portion with an improved design made from molded material and adding rubber shock absorbers on each end to provide better shock absorption. The CLU consists of the main housing, shock absorbers, and handgrips.

MAIN HOUSING

5-19. The main housing (Figure 5-8) is the body of the CLU. It contains the CLU electronics and various gunner controls. The main housing also includes the—

- Battery compartment.
- Test/interface connectors and humidity desiccant plug.
- Sight video port.
- Internal power time meter.
- Day and night vision sights.
- DDC.
- Sight and status display.
- Eyepiece.

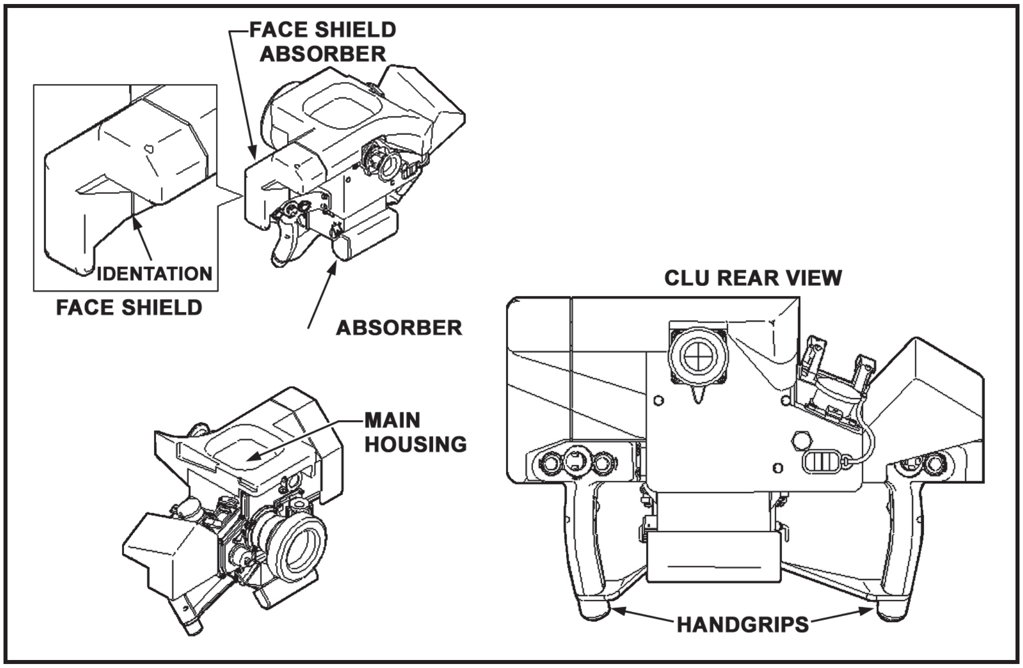

FACE SHIELD ABSORBER
IDENTATION
FACE SHIELD
ABSORBER
CLU REAR VIEW
MAIN HOUSING
HANDGRIPS

Figure 5-8. Main housing.

Battery Compartment and Battery

5-20. The battery compartment (Figure 5-9) is located on the bottom of the main housing.

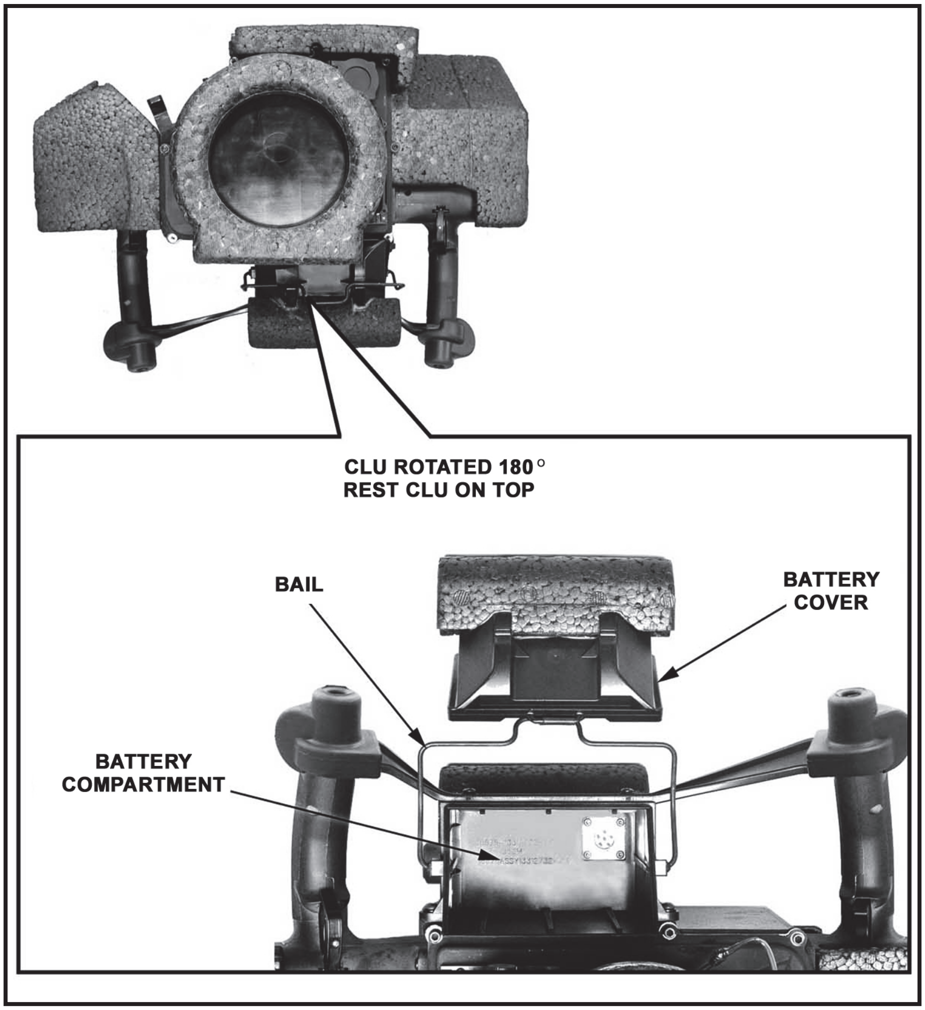


Figure 5-9. Battery compartment.

5-21. The battery compartment houses the non-rechargeable BA-5590/U or the rechargeable BB390A/U battery, and is equipped with a connector that mates with a corresponding connector on the CLU battery. The CLU's battery lasts for at least 4 hours, depending on temperature conditions.

NOTES: 1. BA-5590/U and BB-390A/U batteries are also used in the SINCGARS and the newer advanced systems improvement program (ASIP) SINCGARS. If the battery is completely discharged and there is no replacement battery on hand, the gunner can use a battery from either SINCGARS or ASIP SINCGARS.

2. For training purposes, the BB-390A/U rechargeable battery is used to power the CLU. Refer to Army TM 11-6130-489-13&P for battery recharging procedures.

5-22. To install the CLU battery (Figure 2-16)—

(1) Turn the CLU 180 degrees to reveal the battery compartment.

(2) The battery compartment cover is held in place by a wire bail. Detach and move the wire bail cover out of the way.

(3) The compartment is equipped with a battery connector. This connector mates with the corresponding connector on the battery. Align the two connectors and attach.

(4) Replace the battery compartment cover, and reattach the wire bail.

Test/Interface Connectors and Humidity Protection

5-23. The CLU has several external connectors for testing electronics, a round interface connector, and a moisture-absorbing desiccant plug.

NOTE: The CLU humidity indicator is no longer used.

Test Connector

5-24. The test connector (Figure 5-10) located on the front of the CLU is used to connect the CLU to both direct support level test equipment for maintenance and to the FTT.

Round Interface Connector

5-25. The round interface connector (Figure 5-10) located on the right side of the CLU provides the electrical connection between the CLU and the round.

Desiccant Plug

5-26. The desiccant plug (Figure 5-10) located on the back of the CLU removes moisture from the CLU.

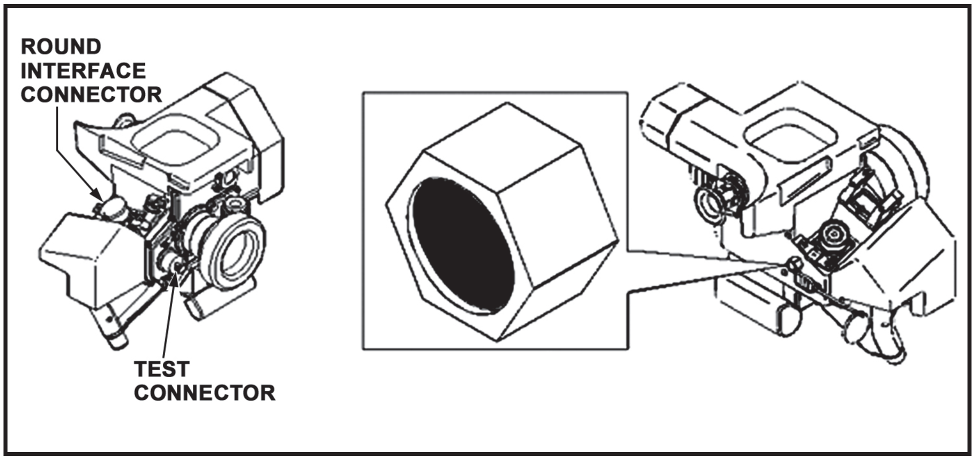


Figure 5-10. Test connector, round interface connector, and desiccant plug.

Video Port

5-27. The video port (Figure 5-11) located on the front of the CLU (above the NVS lens) provides video output or input.

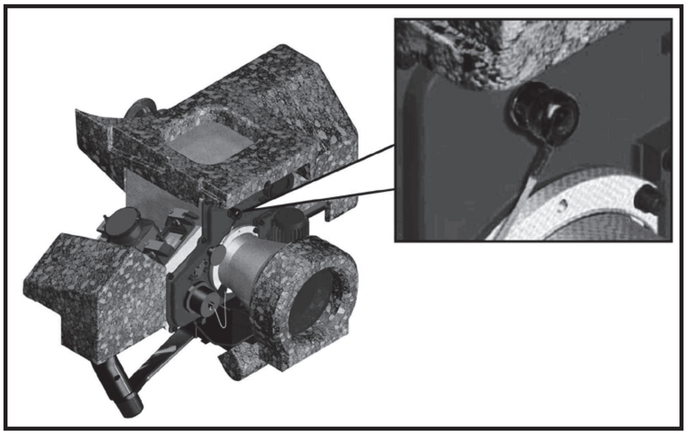


Figure 5-11. Video port.

Elapsed Time Meter

5-28. The elapsed time meter (Figure 5-12) located on the front of the CLU is environmentally protected by a black plastic cover. It records the amount of time that the CLU has been powered and is used for maintenance records only.

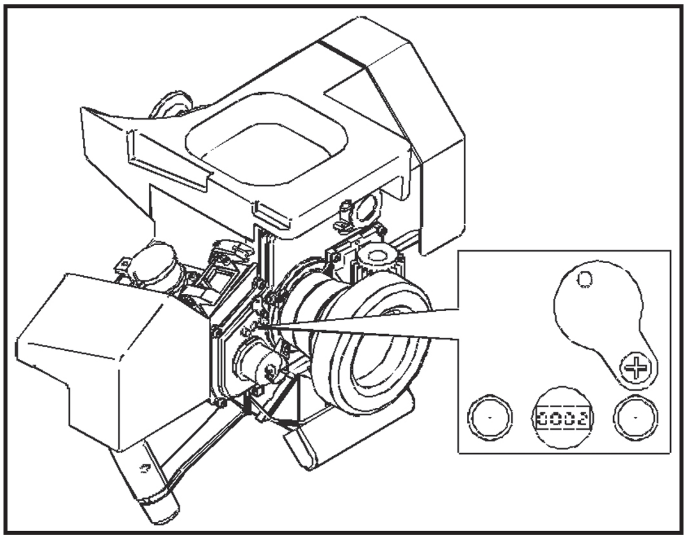


Figure 5-12. Elapsed time meter.

Day and Night Vision Sights

5-29. The CLU's two optical systems, the daysight and the NVS, provide the gunner with three different FOVs.

Daysight

5-30. The daysight (Figure 5-13) is an optical system that works like a telescope. It provides the gunner with a visible light image with 4x magnification for target viewing and battlefield surveillance, but only during the day and when visibility conditions are good. It consists of the following components: daysight lens, eyepiece, and status display.

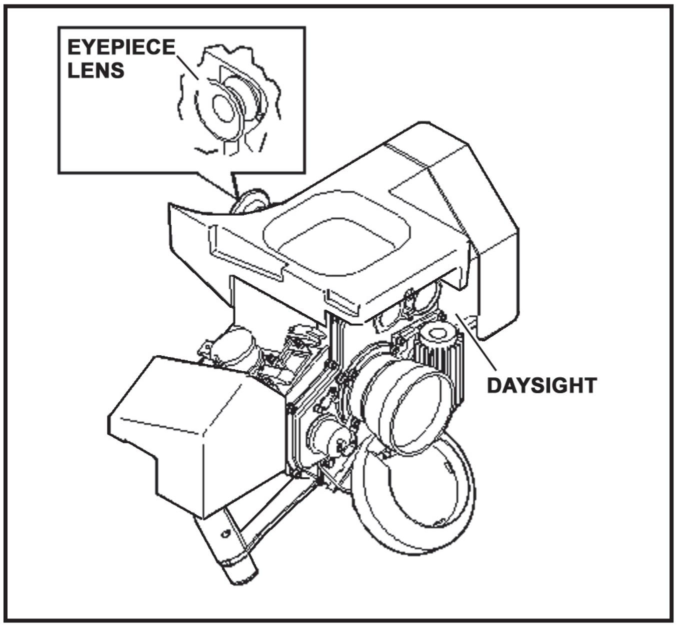


Figure 5-13. Daysight.

Daysight Lens

5-31. The daysight optical path (Figure 5-14) starts at the lens and proceeds to the status display and on to the eyepiece.

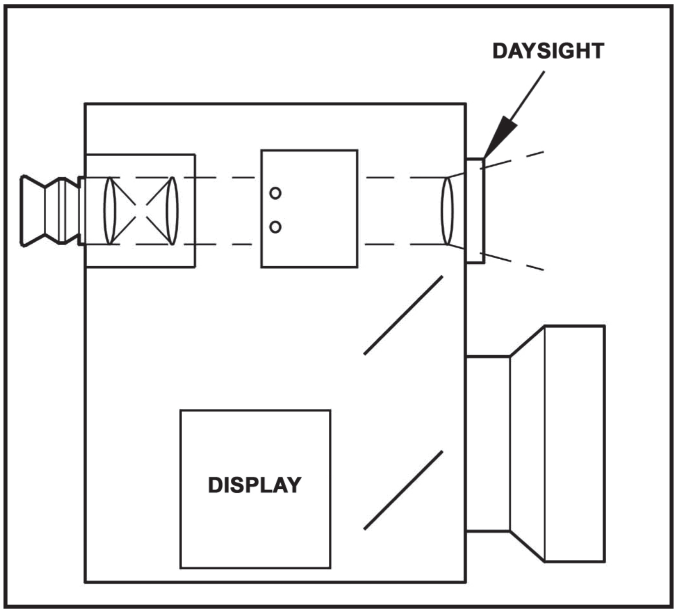


Figure 5-14. Daysight optical path.

Eyepiece

5-32. The gunner views the daysight images through the eyepiece.

Status Display

5-33. The daysight provides the gunner with the day FOV. The day FOV is used for scanning large areas while waiting for the NVS to cool. While the day FOV is effective in good visibility conditions, the gunner will be able to distinguish very little detail about objects seen during periods of limited visibility (Figure 5-15).

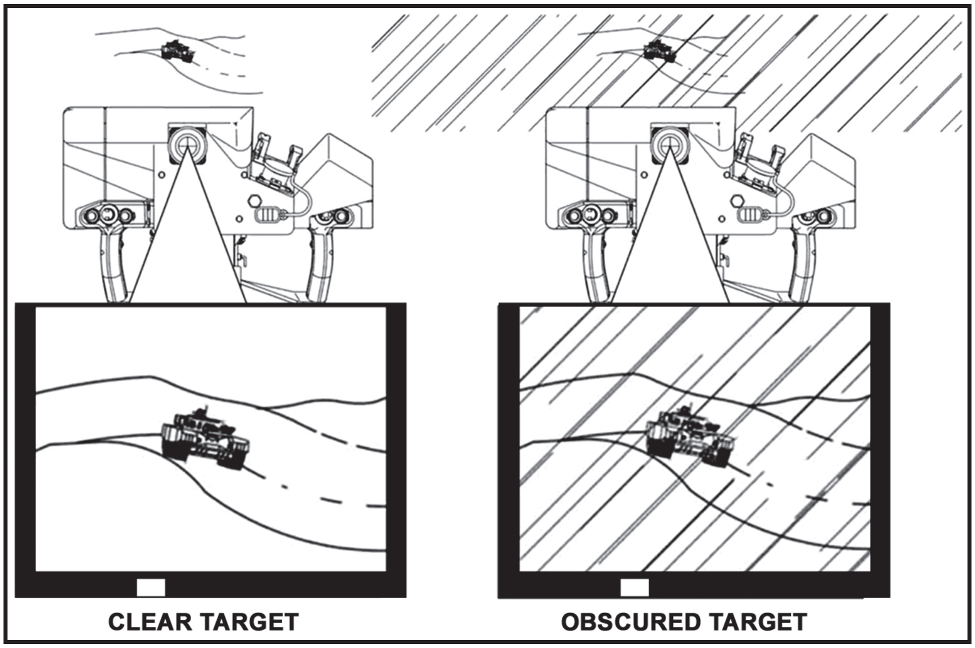


Figure 5-15. Example daysight images—clear and rainy.

Night Vision Sight

5-34. The NVS (Figure 5-16) converts IR target images into visible target images. This allows the gunner to see targets in wide and narrow fields of view during periods of limited visibility. The NVS consists of the—

- NVS lens.
- DDC.
- Video display.
- Flipper mirror.
- Status display.
- Eyepiece.

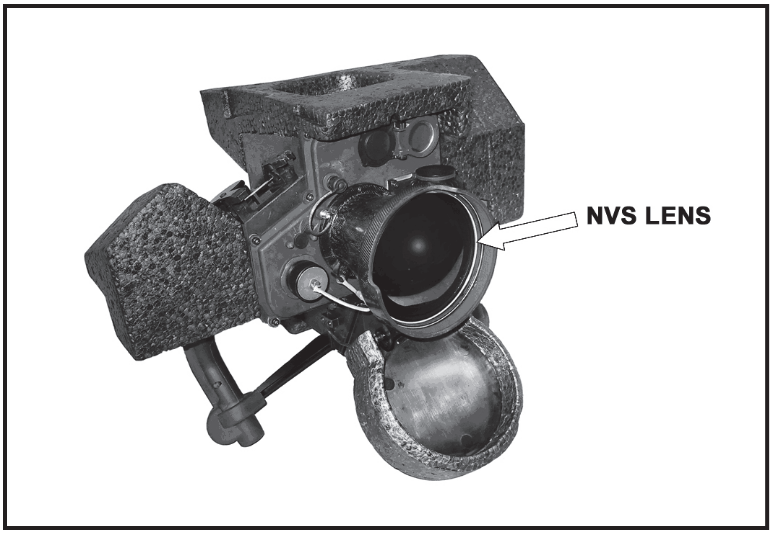


Figure 5-16. Night vision sight.

Night Vision Sight Lens

5-35. When in WFOV or NFOV, the NVS lens (Figure 5-16) focuses the incoming IR light onto the DDC.

Wide Field-of-View

5-36. The WFOV (Figure 5-17A) provides the gunner with 4x magnification of the target scene. With an area of coverage approximately 6º x 4º, WFOV covers a wide area so that the gunner can scan a large general target scene to detect potential targets. However, the gunner will be able to distinguish very little detail about any given object. As a result, WFOV is used only for general surveillance and target detection.

Narrow Field-of-View

5-37. The NFOV (Figure 5-17B) provides the gunner with 12x magnification of the target scene. With an area of coverage approximately 2º x 1.5º, NFOV covers a smaller area than the WFOV, but allows the gunner to see potential targets with greater detail. Therefore, NFOV is used primarily to classify and recognize targets, but it can also be used for BDA.

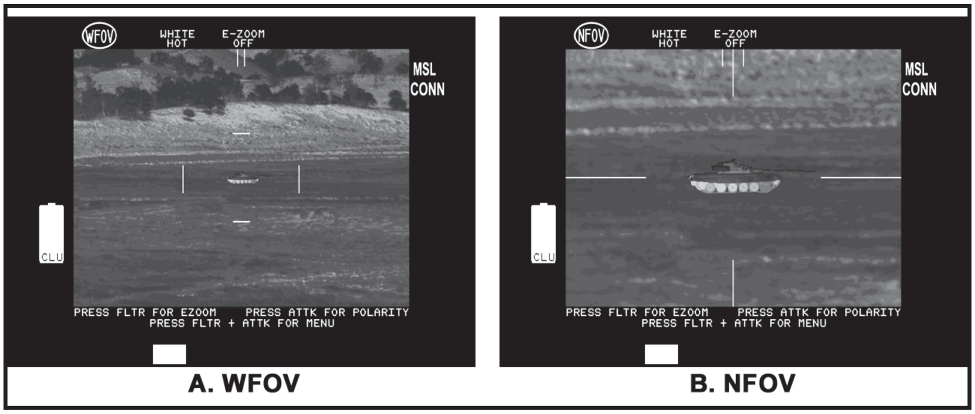

WFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
CLU
PRESS FLTR FOR EZOOM PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
A. WFOV
NFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
CLU
PRESS FLTR FOR EZOOM PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
B. NFOV

Figure 5-17. Night vision sight fields of view.

Detector Dewar Cooler

5-38. The DDC (Figure 5-18) converts the IR target images into electrical signals, which pass through a signal processor to the display.

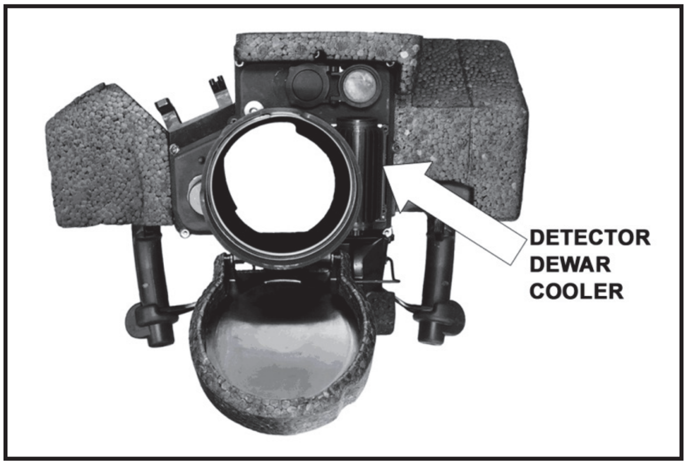

DETECTOR
DEWAR
COOLER

Figure 5-18. Detector dewar cooler.

Video Display

5-39. The video display converts the electrical signals from the DDC into visible images. Mirrors inside the CLU reflect the images so they appear to come from the eyepiece.

Flipper Mirror

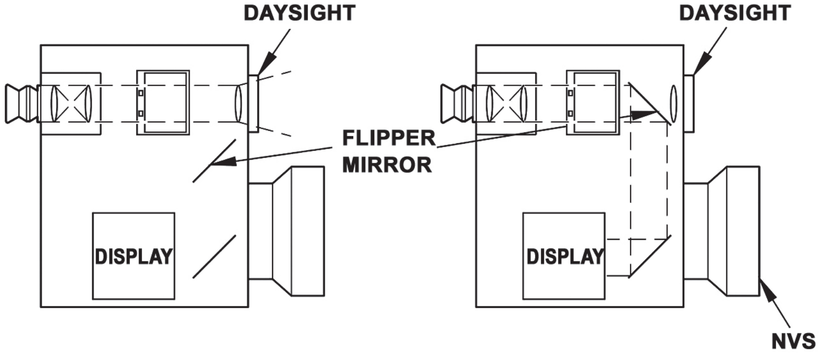
5-40. The flipper mirror allows the gunner to switch between the daysight and the NVS by pressing the SGT SEL switch. This provides the Javelin with its integrated day and night sight capability.

Daysight Position

5-41. The flipper mirror is in the daysight position when the gunner powers up the CLU. When the flipper mirror is in the down position, the gunner can see daysight images (day FOV) (Figure 5-19).

Night Vision Sight Position

5-42. When the flipper mirror is in the up position, the gunner can see NVS images (WFOV and NFOV) (Figure 5-19).

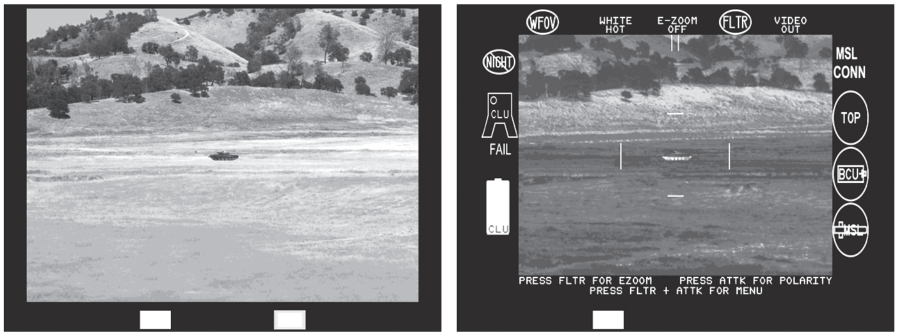

DAYSIGHT
DAYSIGHT
FLIPPER MIRROR
DISPLAY
DISPLAY
NVS

A. DAYSIGHT DOWN POSITION B. NVS AND SEEKER UP POSITION

Figure 5-19. Flipper mirror positions.

Status Display

5-43. The status display provides information about equipment operation. Two light-emitting diodes (LEDs) located at the bottom of the CLU display provide information during day FOV (Figure 5-20A). On the video display, various icons and text messages surround the IR imagery in WFOV, NFOV, and seeker FOV to provide more precise information (Figure 5-20B).


WFOV
WHITE HOT
E-ZOOM OFF
FLTR
VIDEO OUT
NIGHT
CLU
FAIL
CLU
MSL CONN
TOP
BCU
MSL
PRESS FLTR FOR EZOOM PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU

A. DAY FOV (LEDs) B. VIDEO DISPLAY (SYMBOLS AND TEXT MESSAGES)

Figure 5-20. Night vision sight status display.

Eyepiece

5-44. The eyepiece (Figure 5-21) allows the gunner to view the status indicators and images from day FOV, WFOV, NFOV, and seeker FOV. It includes a lens assembly, eyecup, and diopter adjust ring.

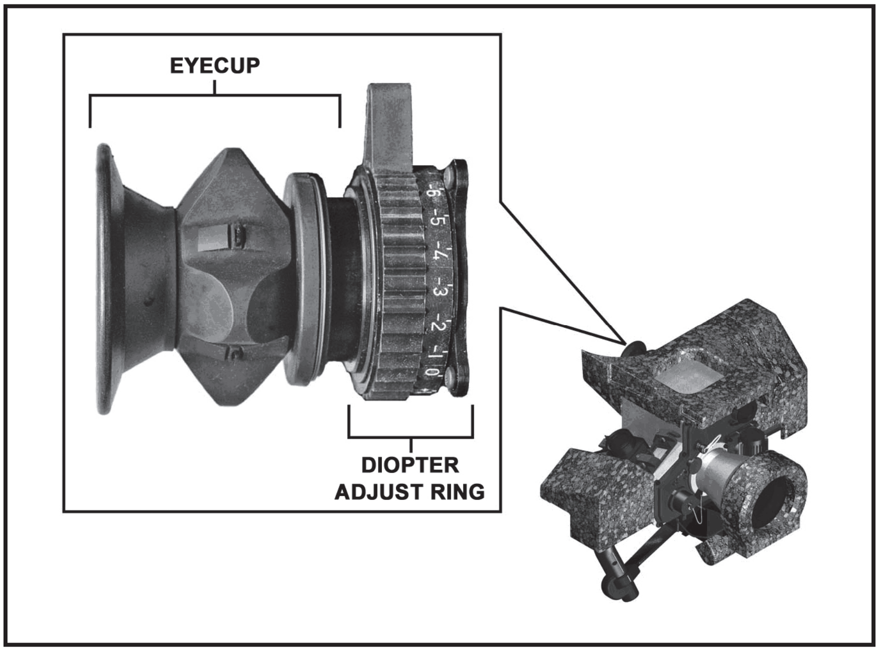


Figure 5-21. Eyepiece.

Lens Assembly

5-45. The lens assembly provides the gunner with the final focus of the CLU display images. It contains a lens that moves in and out when the gunner moves the diopter adjust ring.

Eyecup

5-46. The eyecup is a rubber bellows equipped with four shutter pieces. To view CLU images, the gunner must press his eye against the eyecup, which causes the bellows to collapse and the shutters to open. The eyecup centers the eye on the lens assembly, assists in maintaining the proper distance from the lens assembly to the eye for viewing the CLU images, and provides visible light security when the CLU is on but the gunner is not looking inside.

Diopter Adjust Ring

5-47. The diopter adjust ring is located on the CLU eyepiece. It is a hand-rotated ring that adjusts the focus of the CLU display image to gunner's vision level.

SHOCK ABSORBERS

5-48. The shock absorbers (Figure 5-22) attached to the outside of the CLU's main housing help protect the equipment during field operations. One absorber is a face shield that protects the gunner's face during missile launch.

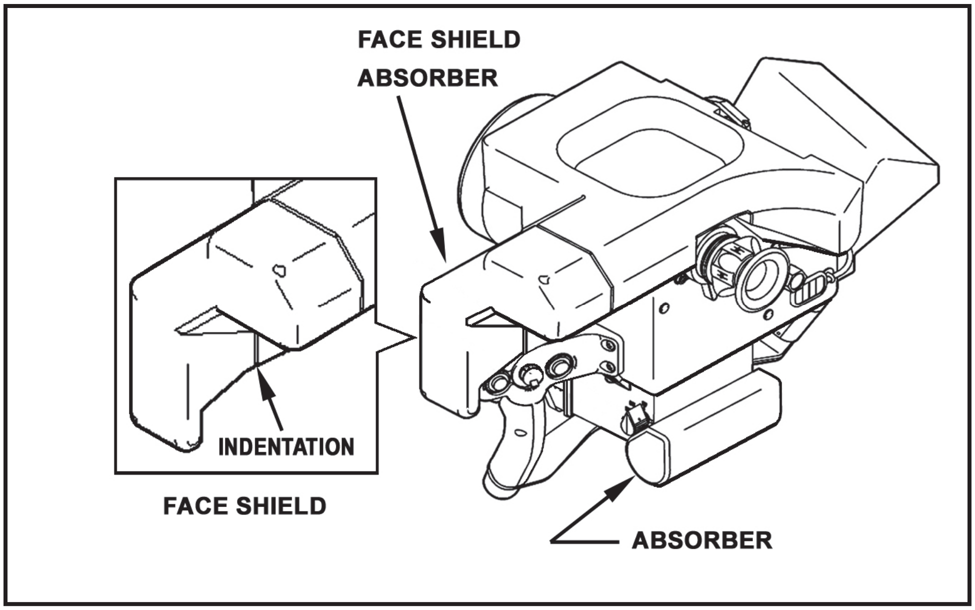

FACE SHIELD
ABSORBER
INDENTATION
FACE SHIELD
ABSORBER

Figure 5-22. Shock absorbers.

HANDGRIPS

5-49. The handgrips (Figure 5-23) are attached to either side of the main housing. They provide a means for the gunner to hold the CLU and are equipped with gunner controls that allow the gunner to direct all Javelin operations.

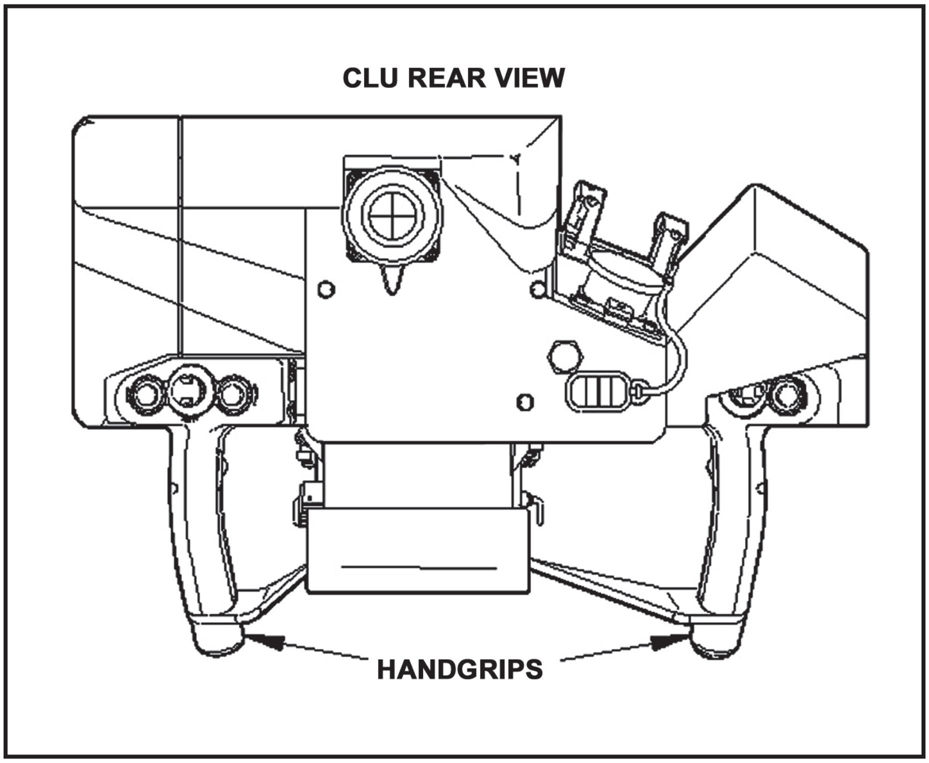

CLU REAR VIEW
HANDGRIPS

Figure 5-23. Handgrips.

CONTROLS AND INDICATORS

5-50. Most of the controls are located on the handgrips, with the exception of the diopter adjust ring and power switch. The diopter adjust ring is located on the eyepiece, and the power switch is located on the CLU main housing.

Diopter Adjust Ring

5-51. The diopter adjust ring (Figure 5-24) is hand-rotated to adjust the focus of the CLU display images to the gunner's vision level. Any gunner with vision correctable to 20/20 can use the CLU and see an in-focus image without using glasses. When wearing a protective mask, the gunner must use his optical inserts if he wears glasses. This occurs because the gunner can no longer place his eye directly on the eyecup.

> **NOTE:** The white mark located on the left side of the mounting plate for the eyepiece is the indicator for the diopter adjust ring.

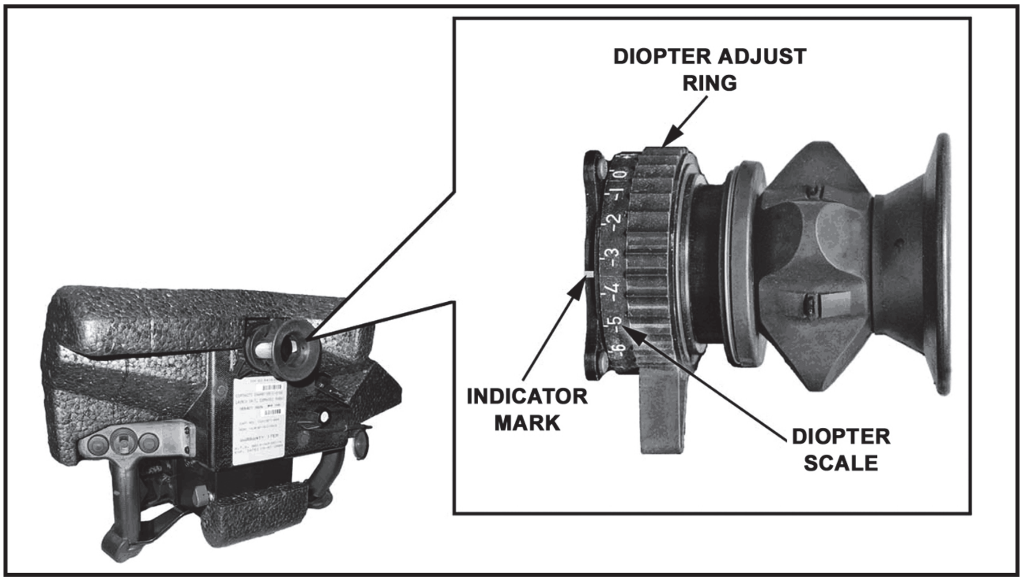


Figure 5-24. Diopter adjust ring.

Power Switch

5-52. The power switch (Figure 5-25) is a rotary switch located on the left side of the CLU main housing, at the lower rear corner. This switch controls the Javelin's mode of operation; each position enables different Javelin capabilities. The power switch has four positions:

- OFF.
- DAY.
- NIGHT.
- TEST.

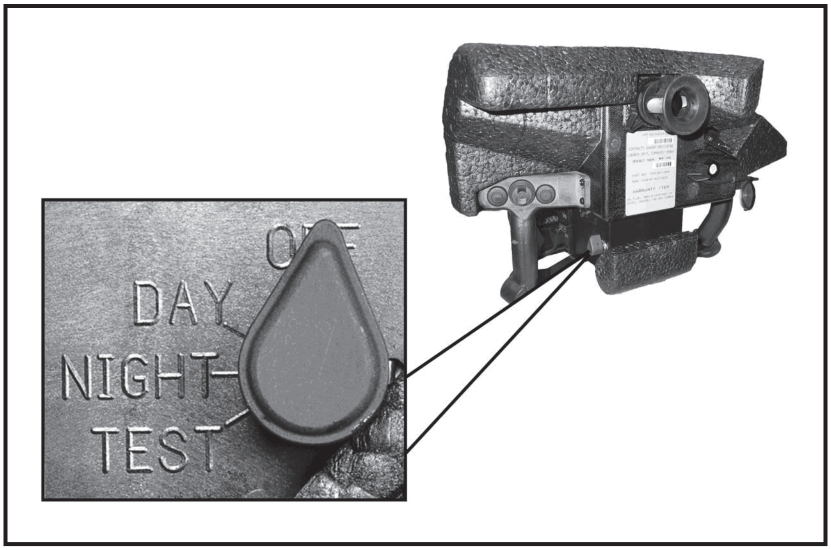


Figure 5-25. Power switch.

OFF Position

5-53. When the power switch is in the OFF position, no battery power is applied to the Javelin. The day FOV can be used for surveillance and target detection, but the NVS cannot be used, the seeker cannot be activated, and the missile cannot be launched.

DAY Position

5-54. When the power switch is in the DAY position, power is applied to the CLU; the gunner has the day FOV, but no NVS. The gunner can also activate the seeker, lock the missile onto a target, and launch the missile.

NIGHT Position

5-55. When the power switch is placed in the NIGHT position, the gunner has full Javelin capability. Once the NVS is cooled down (approximately 2.5 to 3.5 minutes), the gunner can select WFOV, NFOV, and day FOV.

NOTES: 1. The CLU automatically enters a low-power mode (known as the SLEEP mode) when the CLU is in the night mode, the NVS is cooled down, the CLU is not attached to a round, and the CLU is in day FOV for at least 5 minutes. SLEEP mode removes power from all nonessential functions to save battery power, but power is supplied to the DDC to keep the NVS operational. SLEEP mode can also be initiated by entering the CLU menu and selecting SLEEP.

2. The CLU is operational within 10 seconds of exiting the SLEEP mode. To exit the SLEEP mode, press the sight select switch (SGT SEL) or attach the CLU to a round.

TEST Position

5-56. When the power switch is in the TEST position (Figure 5-26), the CLU enters a routine BIT. The power switch is spring-loaded when in this position; when the gunner moves the power switch to the TEST position, it returns to the NIGHT position upon release.

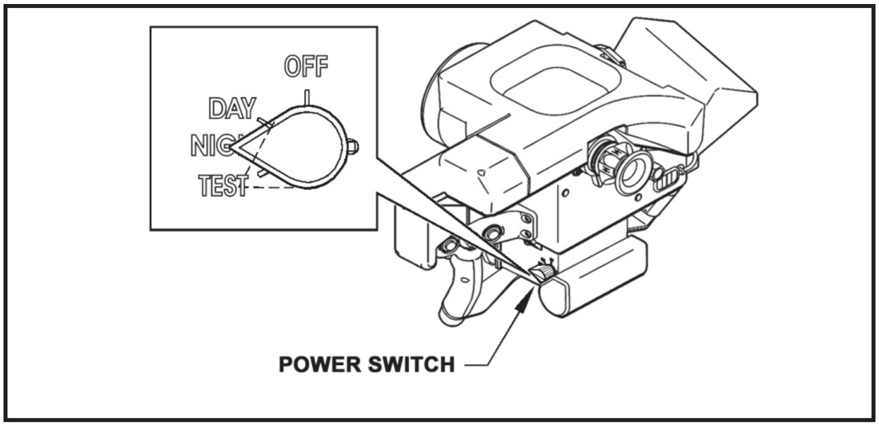


Figure 5-26. Power switch in the TEST position.

OFF Position

5-57. Prior to turning the power switch to the OFF position, the gunner must leave the power switch at DAY for at least one second to give the flipper mirror time to move to the daysight position.

Left Handgrip Controls

5-58. The left handgrip is equipped with the following controls (Figure 5-27): filter switch, focus switch, sight select switch, and seeker trigger. These controls allow the gunner to perform the following actions:

- Select the E-ZOOM.
- Adjust the NVS focus.
- Change the FOV.
- Activate the seeker.
- Lock onto a target/enable the fire trigger.
- Access the CLU menu.
- Select CLU menu options.

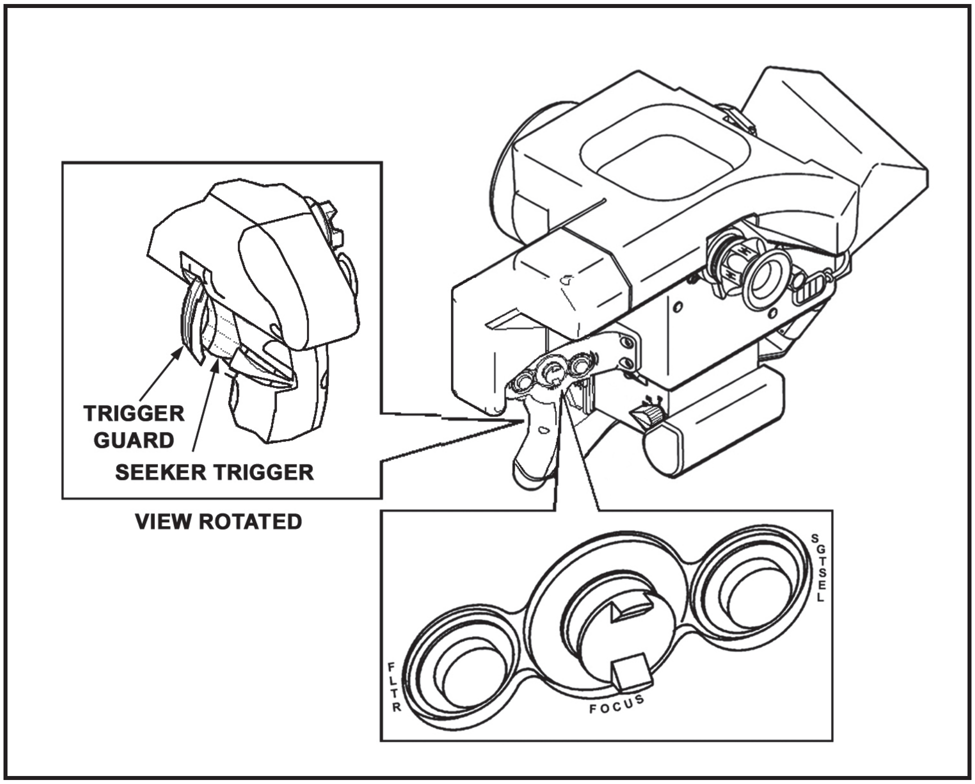


Figure 5-27. Left handgrip controls.

Filter (FLTR) Switch

5-59. The left pushbutton switch, FLTR (Figure 5-28), allows the gunner to select the E-ZOOM, which doubles the WFOV and NFOV magnification. The FLTR switch is also used with the ATTK SEL switch to initiate the MENU function on the CLU. Once in the MENU, the FLTR switch is used to select an option.

Focus (FOCUS) Switch

5-60. The center switch, FOCUS (Figure 5-28), is a spring-loaded, self-centering thumb switch that moves up and down to adjust the focus of NVS images (WFOV and NFOV). It is not operational in the day or seeker FOV.

Sight Select (SGT SEL) Switch

5-61. The right pushbutton switch, SGT SEL (Figure 5-28), has two functions, depending on whether the Javelin is in NVS or seeker operation.

Night Vision Sight Operation

5-62. The NVS function is not available until after NVS cooldown. After cooldown, the SGT SEL switch cycles through day FOV, WFOV, and NFOV. The appropriate status indicator (DAY, WFOV, NFOV) illuminates when the SGT SEL switch is pressed.

Seeker Operation

5-63. The seeker operation function reverts from the seeker FOV to the previous CLU FOV.

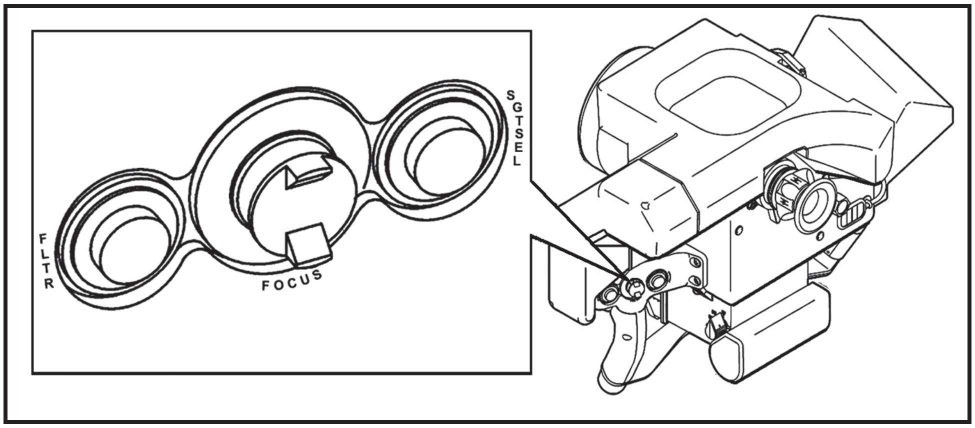


Figure 5-28. Filter, Focus, and Sight Select switches.

Seeker Trigger

5-64. The seeker trigger (Figure 5-29) located at the index finger position on the left handgrip activates the seeker, locks the seeker onto the target, and enables the fire trigger.

NOTE: The seeker trigger is equipped with a trigger guard to prevent accidental seeker activation.

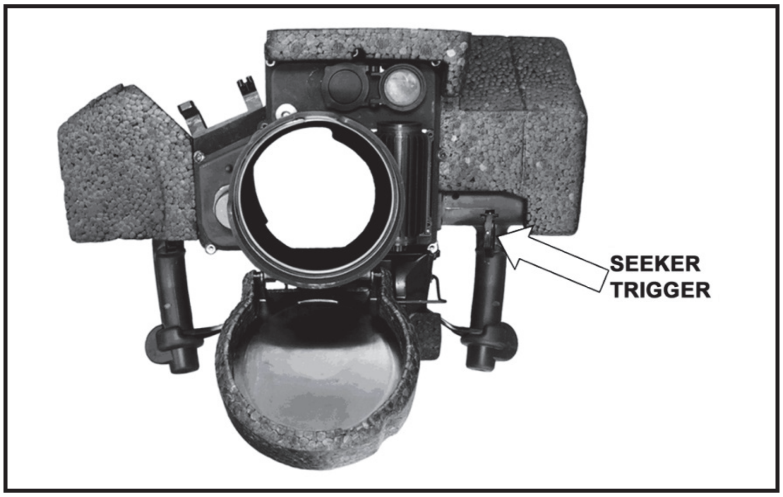


Figure 5-29. Seeker trigger.

Right Handgrip Controls

5-65. The right handgrip is equipped with the GATE ADJ/CTRS & BRT switch, the ATTK SEL switch, and the fire trigger (Figure 5-30). These controls allow the gunner to perform the following actions:

- Adjust NVS contrast and brightness (WFOV and NFOV).
- Adjust the track gates (seeker FOV).
- Change the missile mode.
- Change NVS image polarity.
- Launch the missile.
- Access the CLU menu.
- Change the highlighted CLU menu option.

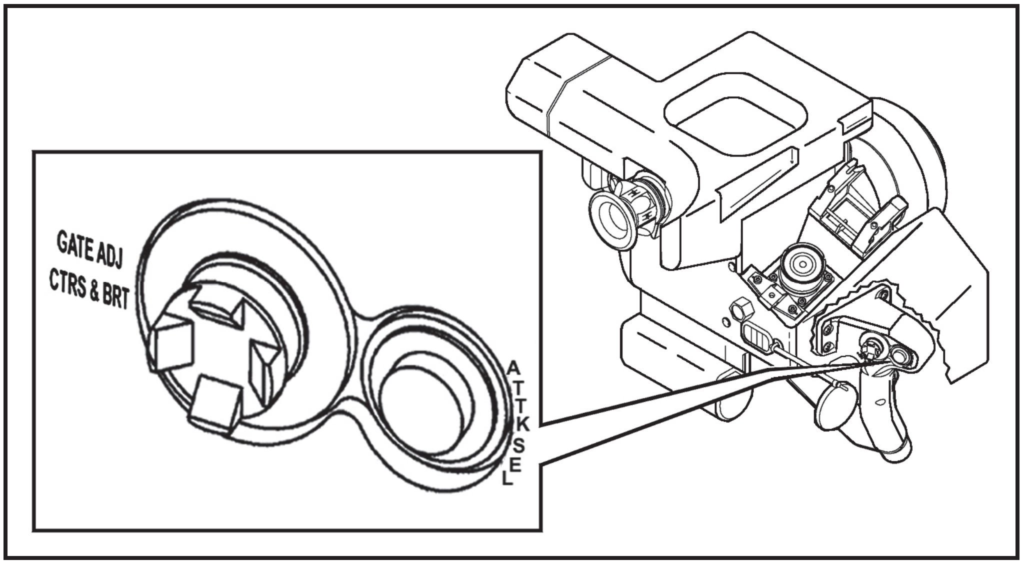


Figure 5-30. Right handgrip controls.

NOTE: Contrast and brightness adjustment works only with the NVS, not with the daysight or the seeker.

Gate Adjustment/Contrast and Brightness (GATE ADJ/CTRS & BRT) Switch

5-66. The left self-centering switch, GATE ADJ/CTRS & BRT (Figure 5-30), moves up, down, left, and right to serve three functions (depending on whether the CLU display image is from the NVS or the seeker).

Night Vision Sight Images

5-67. When the CLU display shows an NVS image (WFOV or NFOV), the GATE ADJ/CTRS & BRT switch can be used to adjust image contrast and brightness.

Seeker Images

5-68. In seeker FOV, the GATE ADJ/CTRS & BRT switch is used to adjust the track gates.

Menu Controls

5-69. When the CLU menu is displayed, the GATE ADJ/CTRS & BRT switch moves the white text from one menu option to the next.

Attack Select (ATTK SEL) Switch

5-70. The right switch, ATTK SEL, has three functions (Figure 5-30).

Missile Mode

5-71. In the seeker FOV, the gunner can select the missile mode for target engagement.

Image Polarity

5-72. In any other FOV, the gunner can change the NVS image polarity from white hot to black hot.

Command Launch Unit Menu

5-73. When activated at the same time as the FLTR switch, the gunner can access the CLU menu.

Fire Trigger

5-74. The fire trigger (Figure 5-31) is located at the index finger position. Once the missile is locked onto the target, the gunner squeezes the fire trigger to launch the missile.

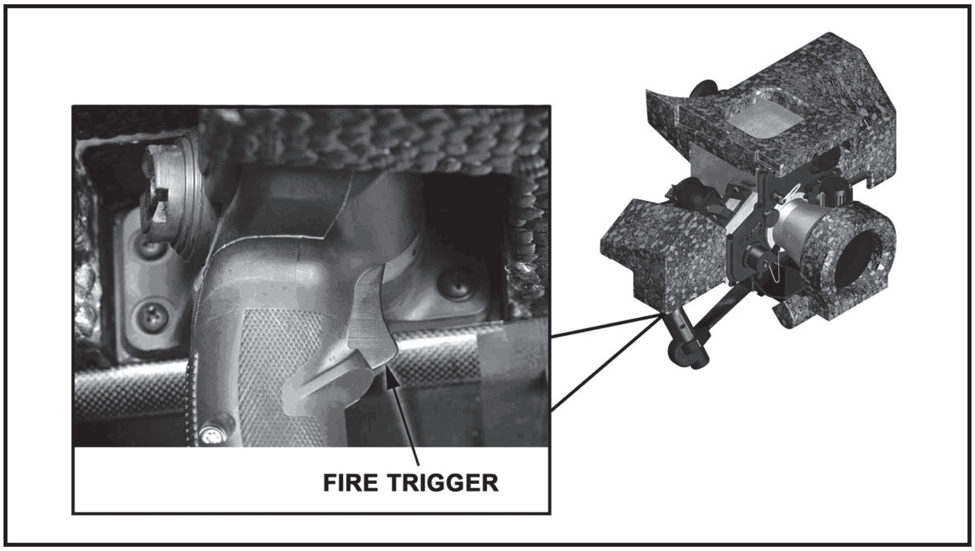


Figure 5-31. Fire trigger.

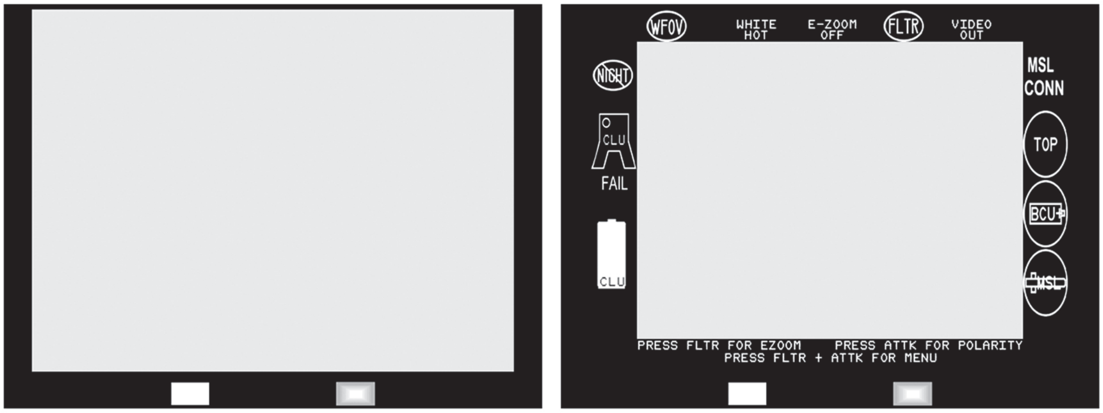
COMMAND LAUNCH UNIT STATUS INDICATORS

5-75. The CLU controls let the gunner tell the Javelin what to do; the CLU indicators let the Javelin tell the gunner how it has responded to his control inputs. The CLU indicators include the status indicators, reticles, track gates, and crosshairs. All are viewed by looking into the eyepiece.

STATUS INDICATORS

5-76. Green, amber, and red status indicators (Figure 5-32B) surrounding the CLU display identify Javelin operational modes, conditions, and malfunctions. They include two LEDs, various symbols, and text messages. The LEDs are located at the bottom of the CLU display and are visible in all FOVs; the symbols and text messages appear on the video display (Figure 5-32A). All status indicators will never illuminate at the same time during normal operation, but a few may illuminate simultaneously. The status indicators may be flashing or solid.

- A solid green indicator identifies normal operation (for information only).
- A flashing green indicator identifies the normal operational equipment limit.
- A solid amber indicator identifies a delay during normal operation.
- A flashing amber indicator serves as a warning to take action before mission capability is lost.
- A solid red indicator signifies that equipment is inoperative.
- A flashing red indicator signifies that corrective action must be taken immediately.



A. LEDs

B. VIDEO DISPLAY (SYMBOLS AND TEXT MESSAGES)

Figure 5-32. Status indicators.

Light-Emitting Diode Indicators

5-77. The LED indicators (Figure 5-33) are visible in all FOVs, but they are mainly used in the day FOV due to the limited information they provide. The LED indicators include the CLU power LED and CLU BIT LED.

Command Launch Unit Power Light-Emitting Diode

5-78. The CLU power LED (Figure 5-33) provides CLU battery status. Located at the bottom left of the CLU display, this green LED has three operational states: solid, flashing, and off.

- The CLU power LED is solid when the CLU battery power is good.
- It flashes when the CLU battery has approximately 2 minutes of power remaining.
- It is off when the CLU battery is dead and when the CLU power switch is in the OFF position.

Command Launch Unit Built-In Test Light-Emitting Diode

5-79. The CLU BIT LED (Figure 5-33) provides the CLU operational status and alerts. Located at the bottom right of the CLU display, this red LED has three operational states: solid, flashing, and off.

- The CLU BIT LED is solid when the CLU fails a BIT.
- It flashes to prompt the gunner to release his trigger(s) or, if no triggers are squeezed, to go to the video display (access the CLU menu if the NVS is not cooled down).
- When the CLU BIT LED is off, Javelin operation is normal.

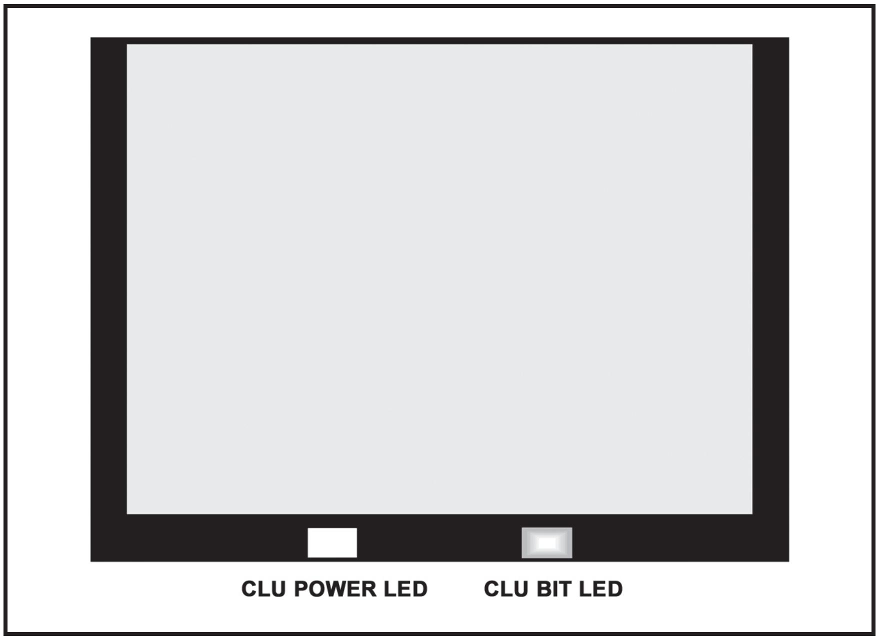


Figure 5-33. Light-emitting diode indicators.

Video Display Status Indicators

5-80. The video display status indicators (Figure 5-34) include icons and text messages. These status indicators are viewed during operations that use the video display (CLU menu, WFOV, NFOV, and seeker FOV); only during day FOV are they not visible. The status indicators are located around the edges of the CLU video display and arranged in sections according to function:

- CLU options (top)
- CLU status (left side)
- Missile status (right side)
- CLU menu (bottom)

5-81. The imagery display area also contains two windows where text messages are displayed: the missile warning message window and the trigger release prompt window.

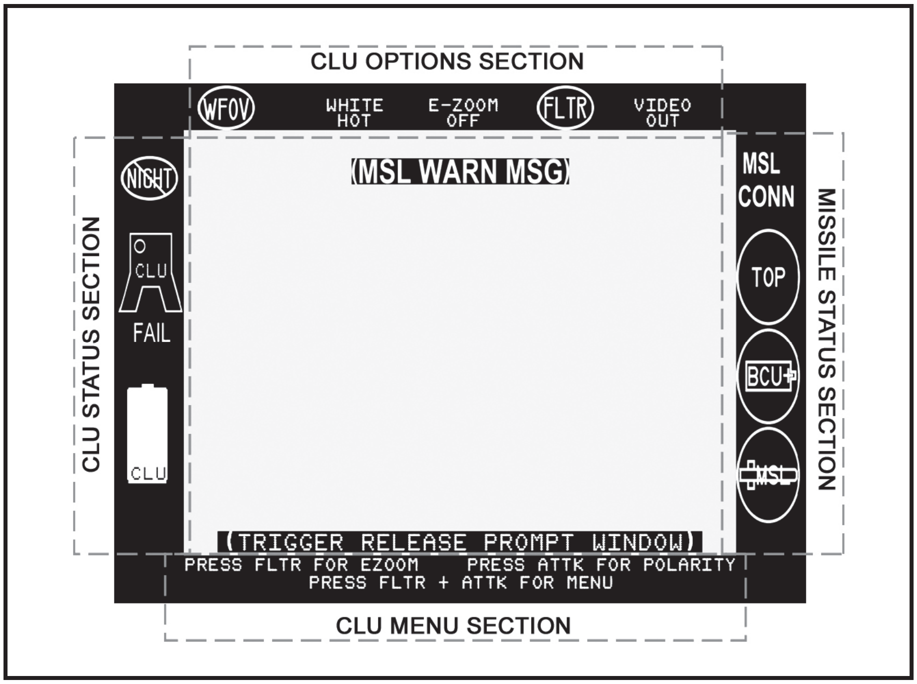

CLU OPTIONS SECTION
WFOV
WHITE HOT
E-ZOOM OFF
FLTR
VIDEO OUT
NIGHT
(MSL WARN MSG)
MSL CONN
CLU STATUS SECTION
CLU
FAIL
CLU
TOP
BCU
MSL
MISSILE STATUS SECTION
(TRIGGER RELEASE PROMPT WINDOW)
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
CLU MENU SECTION

Figure 5-34. Video display status indicators.

COMMAND LAUNCH UNIT OPTIONS SECTION

5-82. The CLU options section (Figure 5-35) includes indicators and text messages that display optional CLU settings.

NOTE: During seeker FOV, these indicators are not displayed.

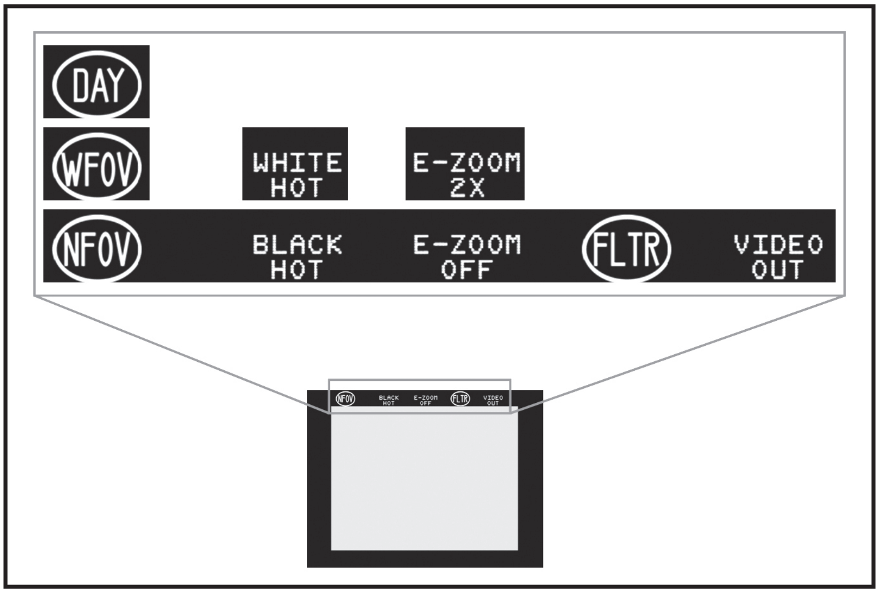

DAY
WFOV
WHITE HOT
E-ZOOM 2X
NFOV
BLACK HOT
E-ZOOM OFF
FLTR
VIDEO OUT

Figure 5-35. Video display status indicators in the command launch unit options section.

Command Launch Unit Field-of-View Indicators

5-83. Three CLU FOV indicators (Figure 5-35) located at the far left of the CLU options section display the current selected CLU FOV: the DAY indicator, WFOV indicator, and NFOV indicator. As the CLU FOV changes, the corresponding indicator appears.

Day (DAY) Indicator

5-84. The green DAY indicator illuminates when the day FOV is selected and the power switch is in the DAY or NIGHT position. However, it is observed only when the CLU menu is accessed during day FOV.

Wide Field-of-View (WFOV) Indicator

5-85. The green WFOV indicator illuminates when the WFOV is selected. It flashes when the NVS is at a focus limit.

Narrow Field-of-View (NFOV) Indicator

5-86. The green NFOV indicator illuminates when the NFOV is selected. It flashes when the NVS is at a focus limit.

Polarity Indicator

5-87. The green polarity indicator located at the left of the CLU display (Figure 5-35) is a text message that displays how objects will appear in the WFOV, the NFOV, and the seeker FOV. It has two settings: WHITE HOT (default) and BLACK HOT. When WHITE HOT is selected, hot objects appear white (bright green) and cold objects appear black. When BLACK HOT is selected, the IR image polarity changes so that hot objects appear black and cold objects appear white (bright green).

E-ZOOM Indicator

5-88. The green E-ZOOM indicator (Figure 5-35) at the right of the CLU display is a text message that displays the NVS image size. It has two settings: E-ZOOM OFF (default) and E-ZOOM 2X. When E-ZOOM OFF is displayed, NVS images are shown at their normal size. When E-ZOOM 2X is displayed, NVS images are shown at twice their normal size.

Filter (FLTR) Indicator

5-89. The green FLTR indicator (Figure 5-35) located to the right of the E-ZOOM indicator indicates the position of the NVS filter. When the FLTR indicator is OFF (default), the NVS filter is removed from the NVS optical path. When the FLTR indicator illuminates, the NVS filter is selected and inserted into the NVS optical path.

Video Port (VIDEO OUT) Indicator

5-90. The green video port indicator (VIDEO OUT) (Figure 5-35) located at the top far right of the CLU video display displays the video port setting. This text message has two indications: OFF (default) and VIDEO OUT. When the video port indicator is OFF, the video port is turned off. When VIDEO OUT is displayed, the NVS/seeker video is provided through the video port.

COMMAND LAUNCH UNIT STATUS SECTION

5-91. Indicators in the CLU status section provide the gunner with information about the operational status of the DDC, CLU electronics, and the CLU battery.

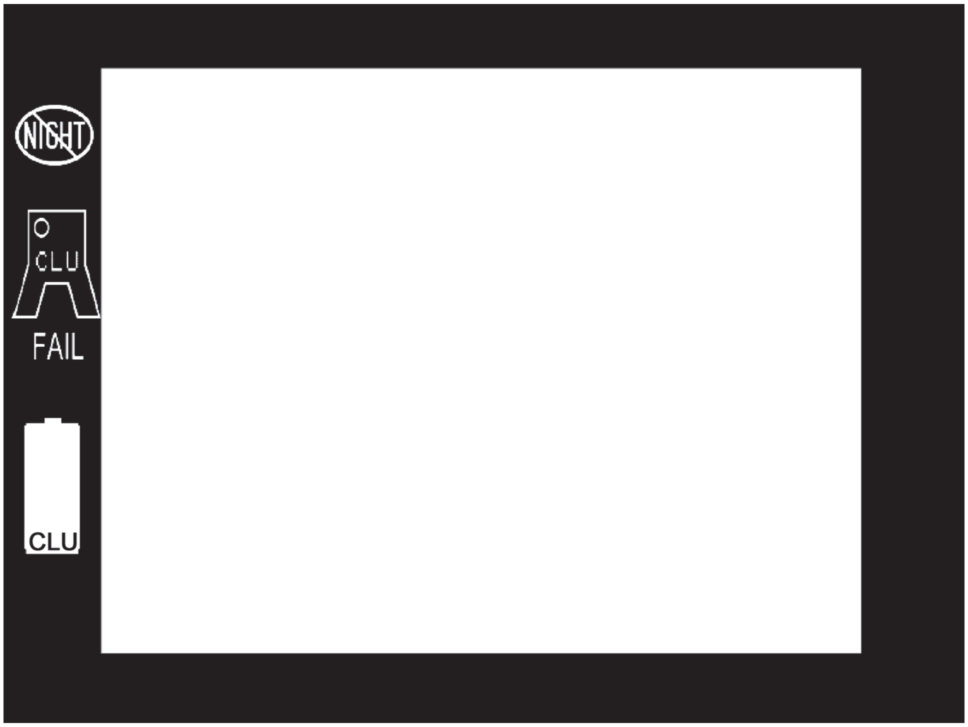


Figure 5-36. Video display status indicators in the command launch unit status section.

Night Vision Sight Not Cool (NVS NOT COOL) Indicator

5-92. The amber NVS NOT COOL indicator (Figure 5-36) located at the top of the CLU status section indicates the cooldown status of the DDC. It illuminates when the CLU power switch is turned to NIGHT and the DDC is cooling down to its operating temperature. During this time, the indicator can be observed only by accessing the CLU menu. The indicator turns off when the DDC is cooled down to its operating temperature.

Command Launch Unit Built-In Test Failure (CLU BIT FAILURE) Indicator

5-93. The red CLU BIT FAILURE indicator (Figure 5-36) located on the left side of the CLU display illuminates when the CLU fails an automatic BIT. It flashes to prompt the gunner to release his trigger(s).

Command Launch Unit Battery (CLU BATTERY) Indicator

5-94. The CLU BATTERY indicator (Figure 5-36) located at the left bottom of the CLU display changes color as the charge on the CLU battery drops and includes a charge level indicator. When a new CLU battery is installed, the battery indicator is green and has a full-level indicator. As the CLU battery is used, the level indicator drops. When the CLU battery charge is at approximately 50 percent, the battery indicator changes to amber, and the level indicator continues to drop. When the CLU battery has approximately 2 minutes of charge remaining, the battery indicator flashes red and the level indicator nears empty. When the CLU battery is spent, the CLU goes to day FOV.

MISSILE STATUS SECTION

5-95. The indicators in the missile status section (Figure 5-37) provide information on missile activation, attack mode, BCU life, and missile BIT.

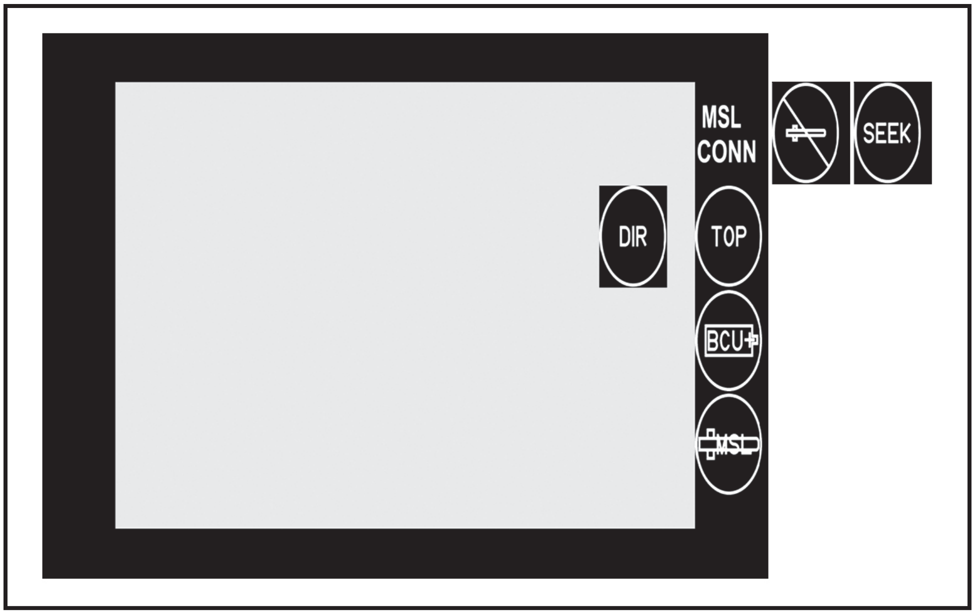


Figure 5-37. Video display status indicators in the missile status section.

Missile Activation Indicators

5-96. Missile activation indicators (Figure 5-37) displayed at the top of the missile status section provide the activation status of the missile. These indicators include MISSILE CONNECTED, MISSILE NOT READY, and the seeker FOV indicators; each indicator replaces the previous one on the display.

NOTE: No indicator is displayed in this area when the CLU is not attached to a round and when the seeker is activated, but the CLU is not in the seeker FOV.

Missile Connected (MSL CONN) Indicator

5-97. The green MSL CONN text message is displayed when the CLU has an electrical connection with the round, but the seeker is not activated.

Missile Not Ready (MISSILE NOT READY) Indicator

5-98. The amber MISSILE NOT READY indicator illuminates during seeker cooldown. (During this time, the missile downloads operating software from the CLU, runs a missile BIT, and cools the seeker.) It flashes as an additional indication that the missile is approaching an overheat condition.

Seeker Field-of-View (SEEK) Indicator

5-99. The green SEEK indicator illuminates when the CLU is in the seeker FOV.

Attack Mode Indicators

5-100. The attack mode indicators (Figure 5-37) located just below the missile activation indicators display the selected missile attack mode: TOP attack or DIR attack. They are displayed when the CLU is in the seeker FOV.

Top Attack (TOP) Indicator

5-101. The green TOP indicator (Figure 5-37) illuminates when the CLU is in the seeker FOV and the missile is in top attack mode (default).

Direct Attack (DIR) Indicator

5-102. The green DIR indicator (Figure 5-37) illuminates when the CLU is in the seeker FOV and the missile is in direct attack mode.

Battery Coolant Unit Indicator

5-103. The amber/red BCU indicator (Figure 5-37) located below the attack mode indicators provides status on the BCU at the end of life. The BCU indicator flashes amber when the BCU has approximately 30 seconds of life remaining. It illuminates red when the BCU is expended.

Missile Built-In Test Failure (MISSILE BIT FAILURE) Indicator

5-104. The red MISSILE BIT FAILURE indicator (Figure 5-37) located at the bottom of the missile status section notifies the gunner of a missile failure. It illuminates when a missile BIT detects a missile failure. It flashes as an additional indication that the missile has failed to launch due to a misfire.

COMMAND LAUNCH UNIT MENU SECTION

5-105. The CLU menu section displays gunner prompts, the CLU menu, and the EXT I/O menu.

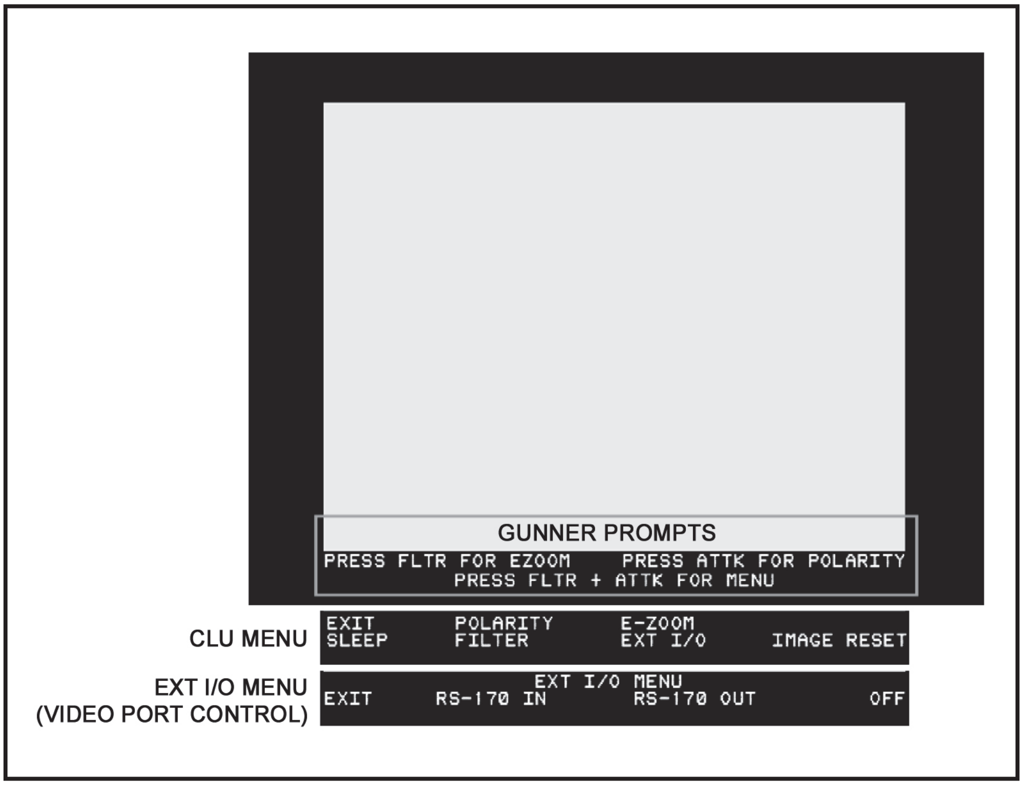

GUNNER PROMPTS
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
CLU MENU
EXIT
SLEEP
POLARITY
FILTER
E-ZOOM
EXT I/O
IMAGE RESET
EXT I/O MENU
(VIDEO PORT CONTROL)
EXT I/O MENU
EXIT
RS-170 IN
RS-170 OUT
OFF

Figure 5-38. Video display indicators in the command launch unit menu section.

Gunner Prompts

5-106. The gunner prompts (Figure 5-38) provide instructions to turn the E-ZOOM on or off, change the IR image polarity, and access the CLU menu. They are displayed in the WFOV and the NFOV, unless replaced by one of the menus. The prompts are not displayed in the seeker FOV when the associated functions are disabled.

Command Launch Unit Menu

5-107. The CLU menu (Figure 5-38) allows the gunner to modify normal CLU operation. CLU menu options include EXIT, POLARITY, E-ZOOM, SLEEP, FILTER, EXT I/O, and IMAGE RESET.

EXIT Option

5-108. The gunner selects the EXIT option to return the gunner prompts to the video display.

POLARITY Option

5-109. The gunner selects the POLARITY option to toggle the IR image polarity between white hot and black hot. The polarity selected is displayed using the polarity indicator in the CLU options section.

E-ZOOM Option

5-110. The gunner selects the E-ZOOM option to toggle between 2x magnification and no extra magnification. The selection is displayed using the E-ZOOM indicator in the CLU options section.

SLEEP Option

5-111. Sleep mode removes power from all nonessential functions (removes power from the video display and changes to day FOV) to save battery power, but power is supplied to provide full mission capability as soon as the gunner requires it. To exit SLEEP mode, the gunner presses the ATTK SEL switch or attaches the CLU to a round. When the CLU is attached to a round, the SLEEP mode is disabled.

FILTER Option

5-112. The gunner selects the FLTR option to insert the NVS filter into or remove it from the NVS optical path (according to the option selected). The option selected is displayed using the FLTR indicator in the CLU options section.

EXT I/O Option

5-113. When the EXT I/O option is selected, the video display shows the EXT I/O menu.

IMAGE RESET Option

5-114. The gunner selects the IMAGE RESET option to reset the NVS image contrast and brightness to their defaults.

External Input/Output Menu

5-115. The EXT I/O menu (Figure 5-38) controls the video port on the front of the CLU. The menu options include EXIT, RS-170 IN, RS-170 OUT, and OFF.

EXIT Option

5-116. The gunner selects the EXIT option to return to the video display.

RS-170 IN Option

5-117. The gunner selects the RS-170 IN option to enable the video port, and video is fed to the CLU display.

RS-170 OUT Option

5-118. When the RS-170 OUT option is selected, the video port is enabled and NVS video is fed out through the port. The video port indicator in the CLU options section changes to VIDEO OUT.

OFF Option

5-119. When the OFF option is selected, the video port is disabled so that video does not feed out from or into the CLU. The video port indicator in the CLU options section is removed.

MENU NAVIGATION

5-120. To access the CLU menu, the gunner presses the FLTR and ATTK SEL switches at the same time, and he uses the GATE ADJ/CTRS & BRT and FLTR switches to select options on the CLU and EXT I/O menus.

- Pressing the GATE ADJ/CTRS & BRT switch moves the white text from one option to the next.
- Pressing the FLTR switch selects the highlighted menu option.

TEXT MESSAGE WINDOWS

5-121. The NVS imagery area contains two windows where text messages are displayed: the missile warning message window and the trigger release prompt window.

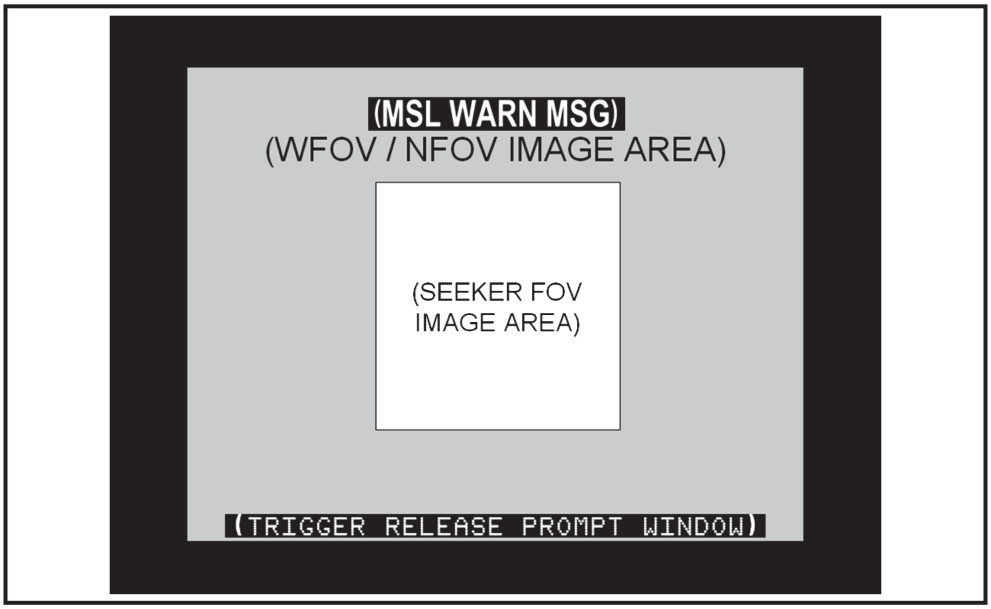


Figure 5-39. Text message windows.

Missile Warning Message Window

5-122. The missile warning message window (Figure 5-39) displays flashing text messages to warn the gunner of situations that require immediate action. The message window is located just above the seeker FOV image area so the flashing message will gain the gunner's attention without obstructing his view of the target. The text messages displayed in this area include those for missile temperature high, misfire, and hangfire.

Missile Temperature High Text Message

5-123. The amber MSL TEMP HIGH text message indicates that the missile is nearing an overheat condition and must be launched as soon as possible.

Misfire Text Message

5-124. The red MISFIRE text message flashes to indicate that the missile failed to launch due to a misfire.

Hangfire Text Message

5-125. The red HANGFIRE text message flashes to indicate that the missile failed to launch due to a hangfire.

Trigger Release Prompt Window

5-126. The trigger release prompt window (Figure 5-39) located at the bottom of the WFOV/NFOV image area (just above the CLU menu section) displays text messages that prompt the gunner to release his trigger(s) when they no longer need to be squeezed or when they are squeezed inadvertently. The prompts displayed in this window include RELEASE SEEKER TRIGGER, RELEASE FIRE TRIGGER, and RELEASE TRIGGERS.

COMMAND LAUNCH UNIT DISPLAY INDICATORS

5-127. Indicators that appear in the CLU display include stadia, reticles, track gates, and crosshairs.

STADIA

5-128. Stadia are seen in all CLU FOVs. They change their appearance and location according to the FOV displayed.

RETICLES

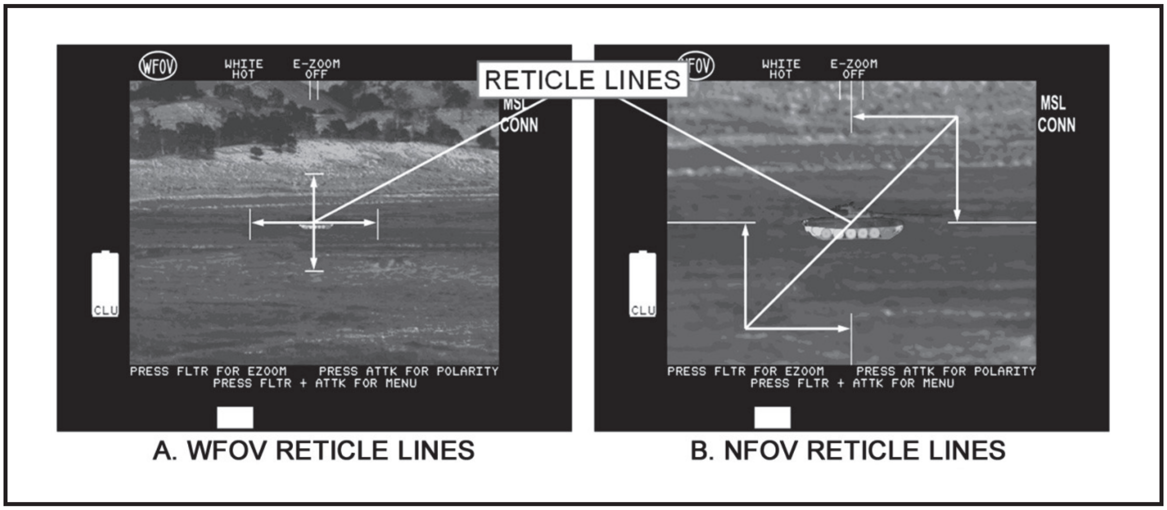
5-129. In WFOV and NFOV, reticles (Figure 5-40) appear on the CLU display. The configuration of lines in the reticles changes from WFOV to NFOV, allowing the gunner to easily identify the FOV used.

Wide Field-of-View Reticle

5-130. In WFOV, the reticle looks like an open-cornered box (Figure 5-40A). The inside of this box defines the area the gunner will see when he selects NFOV.

Narrow Field-of-View Reticle

5-131. In NFOV, the four reticle lines look like crosshairs with the center removed (Figure 5-40B). The vertical lines split the day and NFOV stadia. The square area inside the ends of these lines defines the area that the gunner will see when he selects seeker FOV.



PRESS FLTR FOR EZOOM PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU

PRESS FLTR FOR EZOOM PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU

A. WFOV RETICLE LINES

B. NFOV RETICLE LINES

Figure 5-40. Reticle lines.

Field-of-View Change

5-132. The reticle allows the gunner to keep track of a target when he changes FOV (Figure 5-41). The reticle defines an area within the current FOV that the gunner will see when he changes to the next FOV. As long as the gunner keeps the target within the reticle, he will see the target in the next FOV when he changes it.

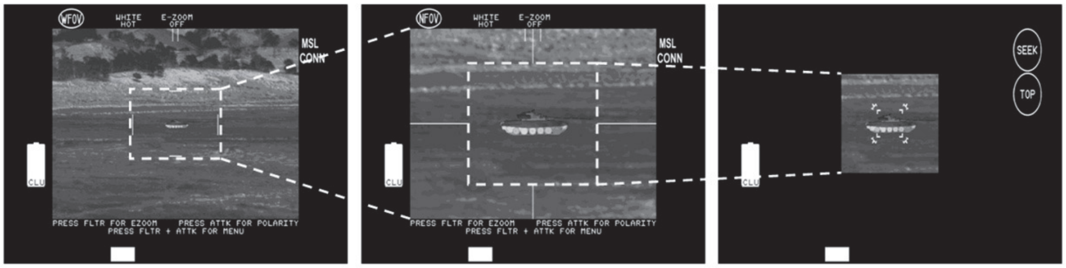

WFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
CLU
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
NFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
CLU
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
SEEK
TOP
CLU

Figure 5-41. Reticle area versus field-of-view change.

TRACK GATES

5-133. See paragraphs 5-185 and 5-186.

CROSSHAIRS

5-134. See paragraph 5-194.

ROUND

5-135. The Javelin round is comprised of—

- An LTA.
- A BCU.
- A missile.

LAUNCH TUBE ASSEMBLY

5-136. The LTA houses the missile and provides the connection with the CLU. It serves as the missile's handling container and launch platform. The LTA (Figure 5-42) consists of a—

- Launch tube.
- Forward and aft end caps.
- Carry handle.
- Shoulder strap.
- Latch assembly.
- Shoulder pad.

NOTE: Once the missile is launched, the LTA is discarded.

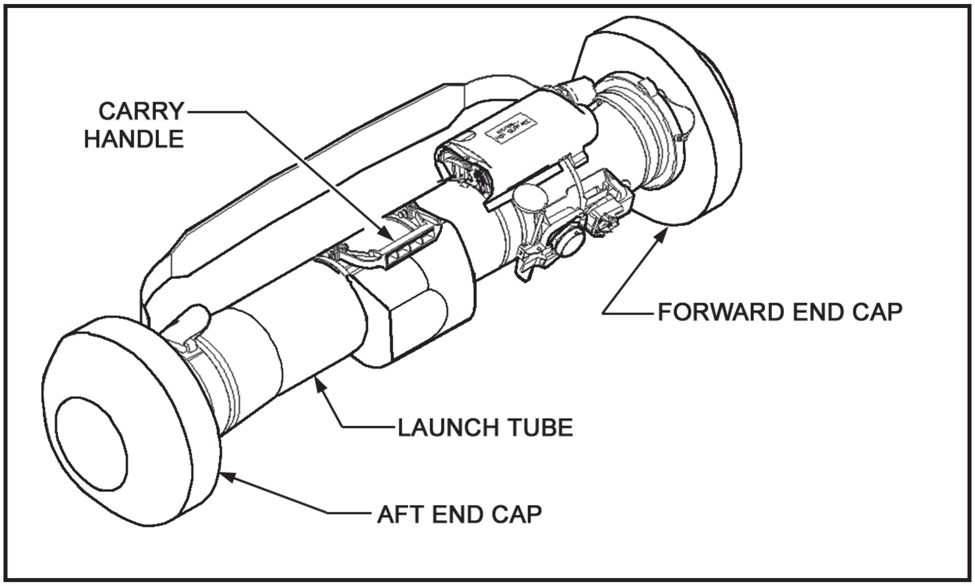


Figure 5-42. Launch tube assembly.

Launch Tube

5-137. The launch tube (Figure 5-42) is a single-piece, composite graphite/epoxy container that protects the missile from the environment before the missile is launched. All other LTA components mount externally onto this tube.

Forward and Aft End Caps

5-138. The forward and aft end caps (Figure 5-42) are designed to protect the missile from damage during transport and handling. Each has a foam shock absorber to protect the round from impact if it is dropped or otherwise abused. The end caps also provide stability and support when the round is strapped in vehicle transit racks or placed on the ground.

Forward End Cap

5-139. The forward end cap protects the missile from moisture, dust, and other potential problems.

NOTE: The forward end cap should not be removed unless the missile is to be launched, and only after the CLU is connected to the round. If the missile is not launched, the gunner ensures that the round is free of foreign material and reinstalls the forward end cap to prevent missile damage.

Aft End Cap

5-140. The aft end cap is permanently attached to the LTA. During launch, the center of the cap is blown out by the blast of the missile launch motor.

Carry Handle

5-141. The carry handle (Figure 5-42) provides a convenient means for the gunner to lift and carry the round.

Latch Assembly

5-142. The latch assembly provides the electrical and mechanical connections between the round and the CLU (Figure 5-43). The latch assembly consists of the following component parts:

- Round hooks for securing the CLU to the LTA.

- A latch release for securing the CLU to the LTA.
- An alignment fork for aligning the CLU to the latching mechanism.
- An alignment pin for maintaining alignment between the CLU and the LTA.
- A CLU interface connector.
- A rubber boot for protecting the LTA's internal components from moisture.
- A lanyard for securing the protective cover to the LTA.
- A protective cover for the CLU interface connector.

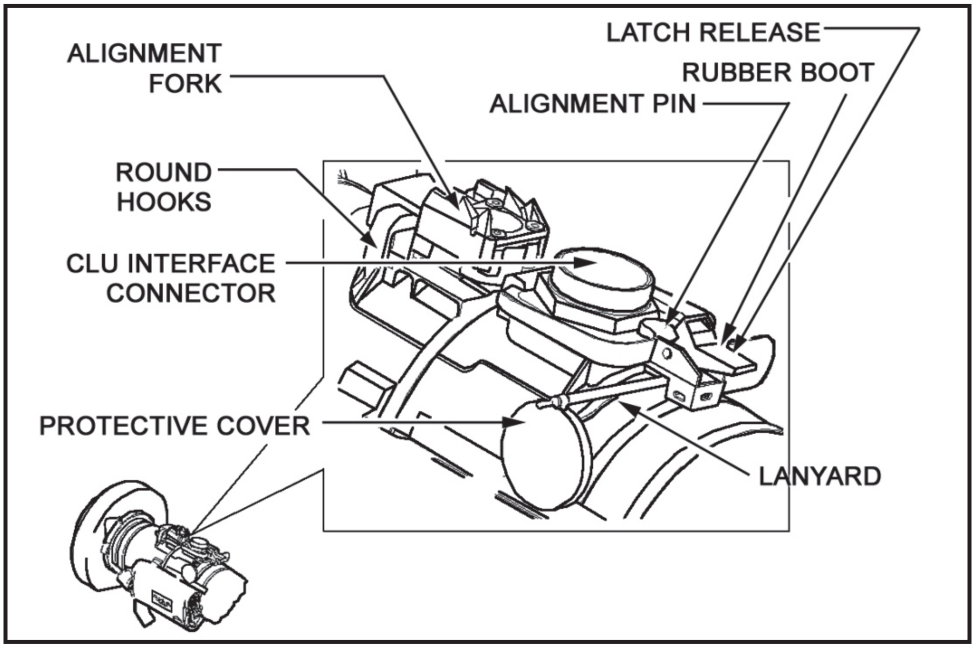


Figure 5-43. Command launch unit mounting brackets.

Round Hooks

5-143. The round hooks (Figure 5-43), two metal loops located at the front of the latch assembly, hook into the forks on the CLU interface bracket to secure the CLU to the round.

Latch Release

5-144. The latch release (Figure 5-43), a spring-loaded mechanism located at the rear of the latch assembly, engages the CLU interface catch to secure the CLU to the round.

Alignment Fork

5-145. The alignment fork (Figure 5-43) is a slotted metal device located behind and above the round hooks. As the gunner connects the CLU to the round, the alignment fork engages the alignment bar on the CLU. This guides the CLU into place to ensure proper engagement of the latching mechanism and the interface connectors.

Alignment Pin

5-146. The alignment pin (Figure 5-43) is a conical post located on the rear of the latch assembly, just below the latch release. It engages a hole in the round interface catch on the CLU to maintain mechanical alignment between the CLU and the round.

Command Launch Unit Interface Connector

5-147. The CLU interface connector (Figure 5-43), the counterpart to the round interface connector on the CLU, provides the electrical connections between the round and CLU. All signals between the CLU and round—missile control signals, squib firing signals, and seeker video signals—pass through this connector.

Rubber Boot

5-148. A rubber boot (Figure 5-43) located around the bottom of the CLU interface connector keeps water, dirt, and debris out of the round internal components.

Lanyard

5-149. The lanyard (Figure 5-43), a rubber cable secured to the latch assembly chassis below the latch release, secures the protective cover for the CLU interface connector to the LTA. The lanyard is equipped with a tab that lets the gunner move the protective cover when connecting the CLU to the round.

Protective Cover

5-150. The protective cover (Figure 5-43), an aluminum cap that attaches to the CLU interface connector, prevents dirt and debris from entering the CLU interface connector.

Shoulder Strap and Pad

5-151. The shoulder strap (Figure 5-42) adjusts for easy transport, and the shoulder pad allows the gunner to balance and support the Javelin when it is placed on the shoulder.

BATTERY COOLANT UNIT

5-152. The BCU (Figure 5-44) cools and powers the missile. It consists of two sections: a battery section and a compressed-gas coolant section.

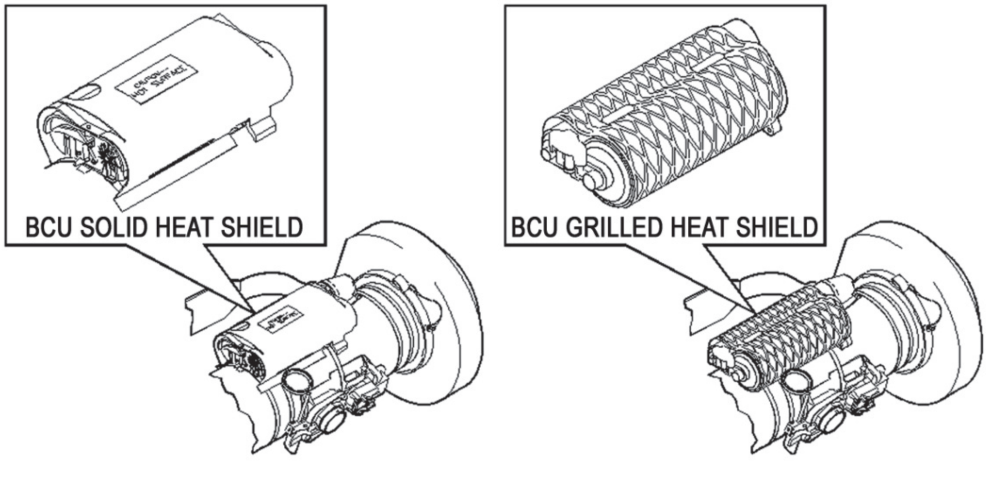


Figure 5-44. Battery coolant unit.

Battery Section

5-153. The battery section powers the missile electronics prior to launch.

Coolant Section

5-154. The coolant section cools the seeker to its operating temperature prior to missile launch.

NOTE: There are two interchangeable versions of the BCU—one with a solid heat shield and another with a grilled heat shield.

MISSILE OPERATION

5-155. The missile (Figure 5-45) carries all of the components necessary to deliver an HE shaped charge to the target. It acquires a selected target, tracks the target during flight, directs itself to intercept the target, and detonates the warhead on impact with the target. The Javelin missile consists of several sections:

- A guidance section.
- A warhead section.
- A mid-body section.
- A propulsion section.
- A control actuator section.

5-156. These sections work in unison from missile launch until target impact.

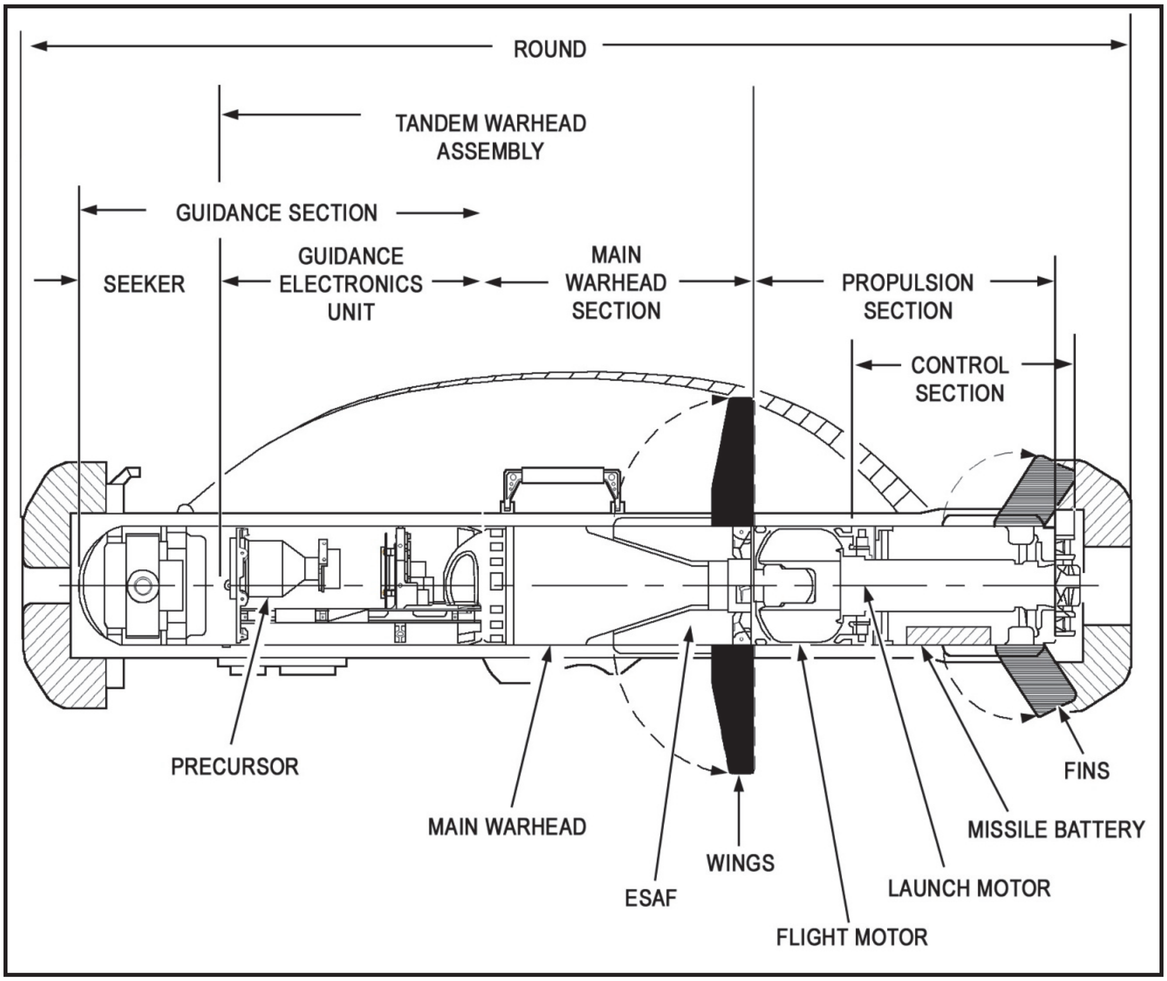

ROUND
TANDEM WARHEAD ASSEMBLY
GUIDANCE SECTION
SEEKER
GUIDANCE ELECTRONICS UNIT
MAIN WARHEAD SECTION
PROPULSION SECTION
CONTROL SECTION
PRECURSOR
MAIN WARHEAD
ESAF
WINGS
FLIGHT MOTOR
LAUNCH MOTOR
MISSILE BATTERY
FINS

Figure 5-45. Javelin missile.

GUIDANCE SECTION

5-157. The forward section of the missile, the guidance section (Figure 5-45), provides target tracking and flight control signals. It includes the seeker head and the guidance electronics unit.

Seeker Head

5-158. The seeker head provides 9x magnification of the target scene (seeker FOV [Figure 5-46]) and creates an IR target image, similar to the NVS in the CLU. The seeker head houses the IR sight and the crush switch.

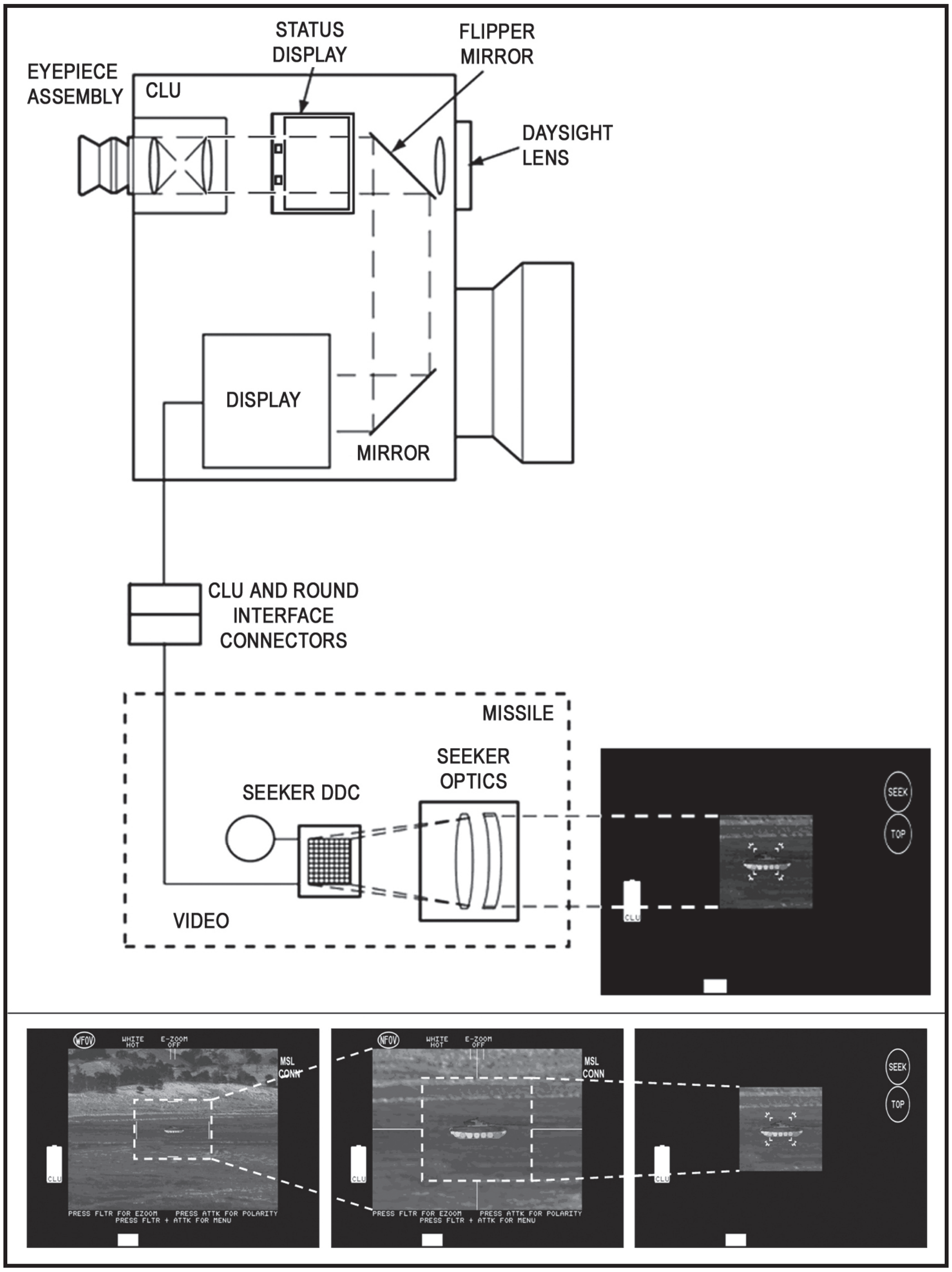

STATUS DISPLAY
FLIPPER MIRROR
EYEPIECE ASSEMBLY
CLU
DAYSIGHT LENS
DISPLAY
MIRROR
CLU AND ROUND INTERFACE CONNECTORS
MISSILE
SEEKER OPTICS
SEEKER DDC
VIDEO
SEEK
TOP
CLU
WFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
NFOV
WHITE HOT
E-ZOOM OFF
MSL CONN
PRESS FLTR FOR EZOOM
PRESS ATTK FOR POLARITY
PRESS FLTR + ATTK FOR MENU
SEEK
TOP

Figure 5-46. Seeker field-of-view.

Infrared Sight

5-159. The IR sight, along with the guidance electronics unit and the control actuator section, gives the missile its fire-and-forget capability. It contains the optics and the DDC for seeker FOV.

Optics

5-160. The optics focus the incoming IR light onto the seeker DDC.

Detector Dewar Cooler

5-161. The DDC converts the IR light into an electrical signal. Then, it sends it to the CLU display through the CLU and round interface connectors. The display converts the electrical signals from the seeker into visible images (seeker FOV), which are sent to the gunner by the same path as NVS images (Figure 5-46).

5-162. After using NFOV to identify the target and determine whether or not it is engageable, the gunner activates the seeker to engage the target. Upon missile launch, the seeker FOV image is sent to the guidance electronics section. During flight to the target, the IR sight tracks the target and sends target location information to the guidance electronics unit.

NOTES: 1. The missile seeker's FOV is used only to lock the missile onto a target.

2. Images in seeker FOV have fewer details than images from the NVS. However, when you use seeker FOV, the gunner already knows what the target is, so target image details are not necessary.

Crush Switch

5-163. The crush switch begins the detonation sequence for the warhead when the missile impacts with the target.

Guidance Electronics Unit

5-164. The guidance electronics unit (Figure 5-47) serves the following functions:

- Before missile launch, it communicates with the CLU by—
    - Sending video of the seeker FOV and messages about round status (BCU battery spent, missile overheat, missile failure of BIT, misfire, and hangfire) to the CLU.
    - Responding to inputs from the GATE ADJ/CTRS & BRT switch, the ATTK SEL switch, the seeker trigger, and the fire trigger.
- After lock-on, it continuously points the seeker at the target.
- After missile launch, it sends signals to the control actuator section to guide the missile to the target during flight.

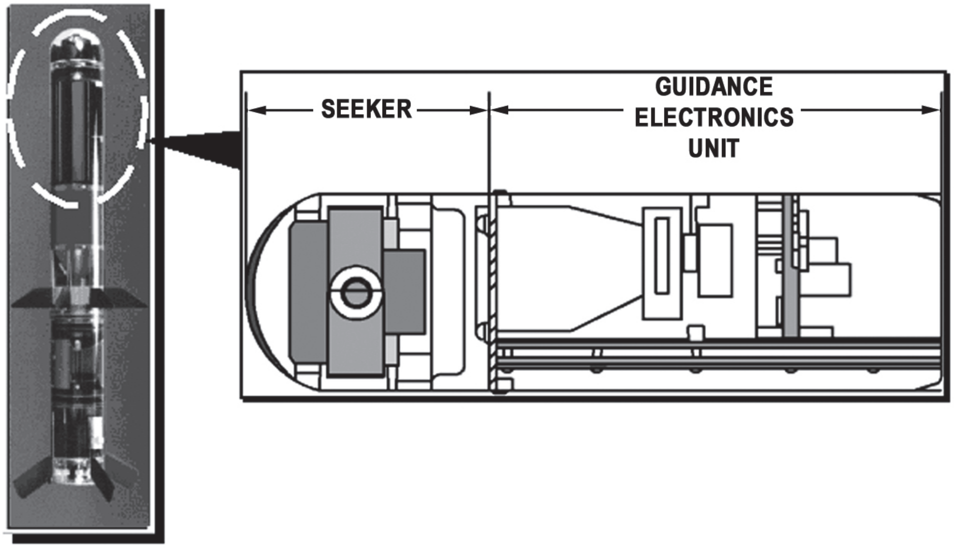

SEEKER
GUIDANCE ELECTRONICS UNIT

Figure 5-47. Guidance section.

WARHEAD SECTION

5-165. The warhead components (Figure 5-48) are located in the guidance section and in the mid-body section. The components include a precursor charge and a main charge.

Precursor Charge

5-166. The precursor charge counteracts the effects of reactive armor.

Main Charge

5-167. The main charge penetrates the main hull armor.

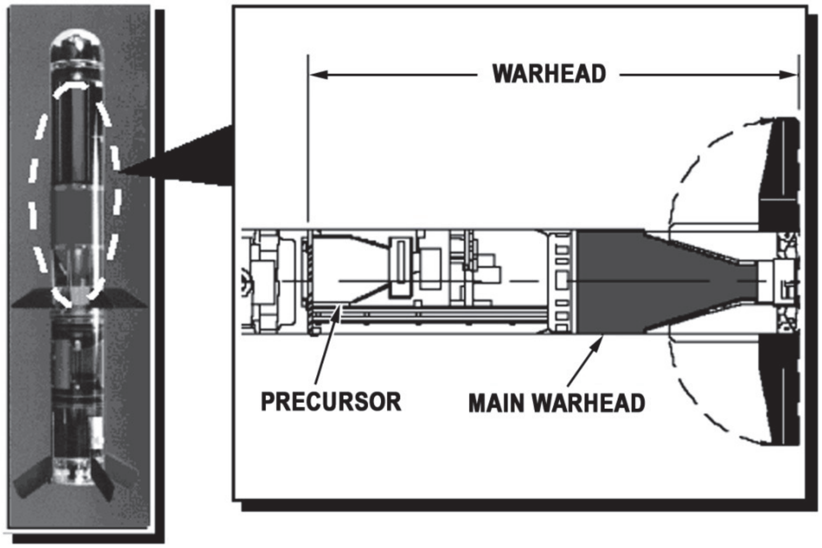

WARHEAD
PRECURSOR
MAIN WARHEAD

Figure 5-48. Warhead section.

MID-BODY SECTION

5-168. The mid-body section (Figure 5-49) includes the wings, the main charge, and the ESAF electronics.

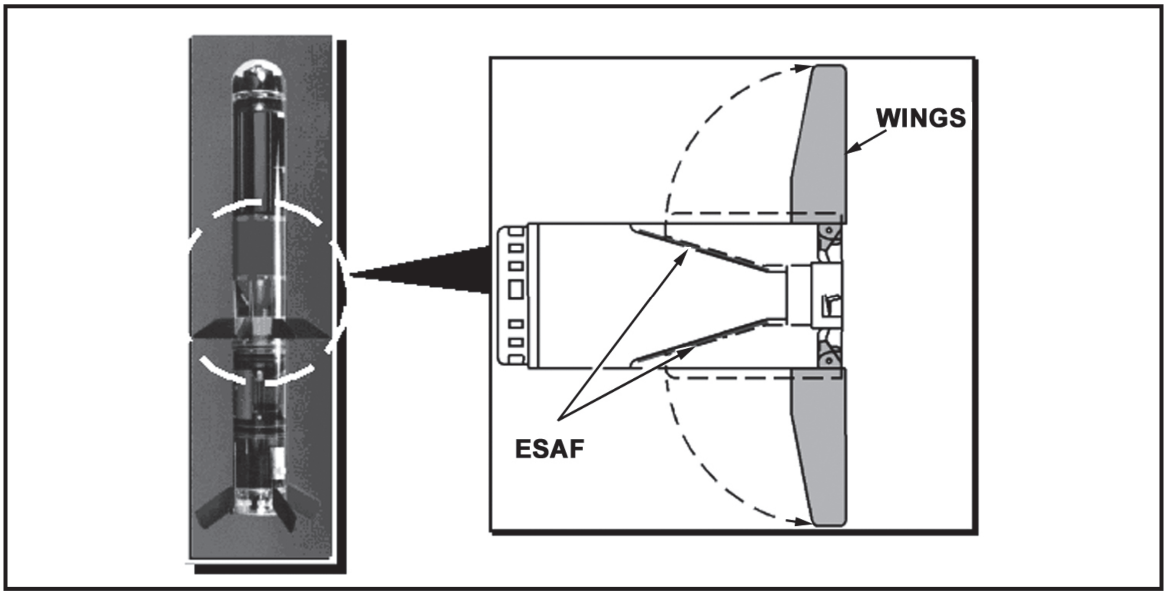


Figure 5-49. Mid-body section.

Flight Control Wings

5-169. Similar to the feathers on a dart, the wings provide aerodynamic stability as the missile flies to the target. When the missile is in the LTA, the wings fold into slots in the missile's skin. Then, the spring-loaded wings deploy into a fixed position when the missile is launched.

Electronic Safe, Arm, and Fire and Main Charge

5-170. The ESAF controls the initiation of the missile motors and the detonation of the warhead charges.

PROPULSION SECTION

5-171. The propulsion section (Figure 5-50) provides thrust to propel the missile to the target. It has two motors: the launch motor and the flight motor.

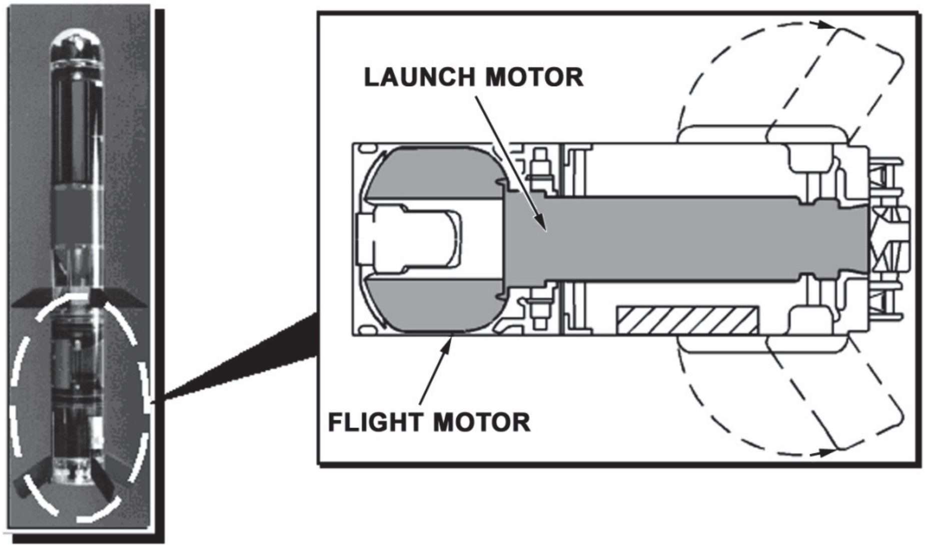


Figure 5-50. Propulsion section.

Launch Motor

5-172. The launch motor propels the missile approximately 15 feet away from the gunner to limit blast effects of the flight motor.

Flight Motor

5-173. The flight motor propels the missile to the target at the rate of about 1000 meters per 7 seconds (approximately 514 kilometers per hour or 319 miles per hour).

CONTROL ACTUATOR SECTION

5-174. The control actuator section (Figure 5-51) receives control signals from the guidance electronics unit. In response to these signals, the control actuator section moves its flight control surfaces to change the missile flight path.

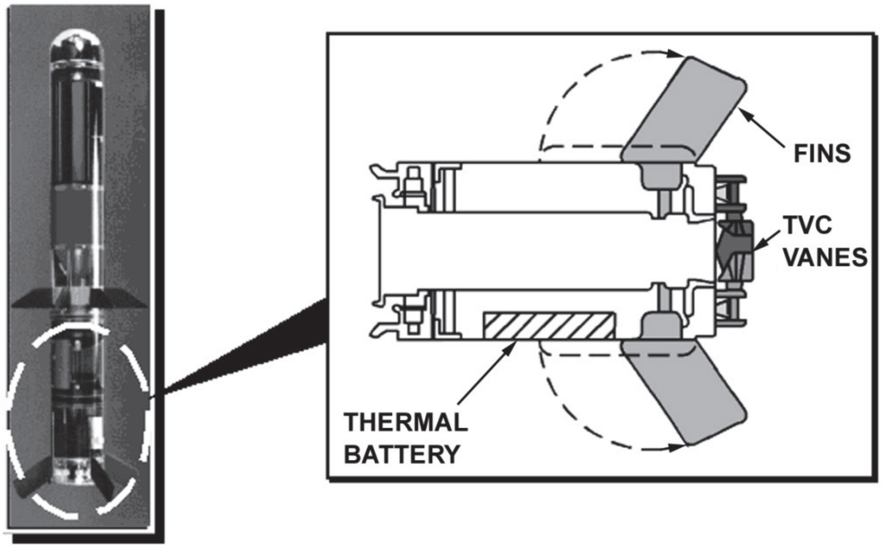


Figure 5-51. Control actuator section.

ROUND CONTROLS

5-175. The Javelin round controls are located on the left handgrip, right handgrip, and forward end cap of the CLU.

LEFT HANDGRIP CONTROLS

5-176. Two left handgrip controls are used during seeker operation: the seeker trigger and the SGT SEL switch.

Seeker Trigger

5-177. The seeker trigger is located on the left handgrip at the index finger position (Figure 5-52). The seeker trigger serves the following purposes:

- Activates the seeker.
- Locks the seeker on the target.
- Enables the fire trigger.

5-178. A trigger guard covers the seeker trigger to prevent accidental activation of the BCU.

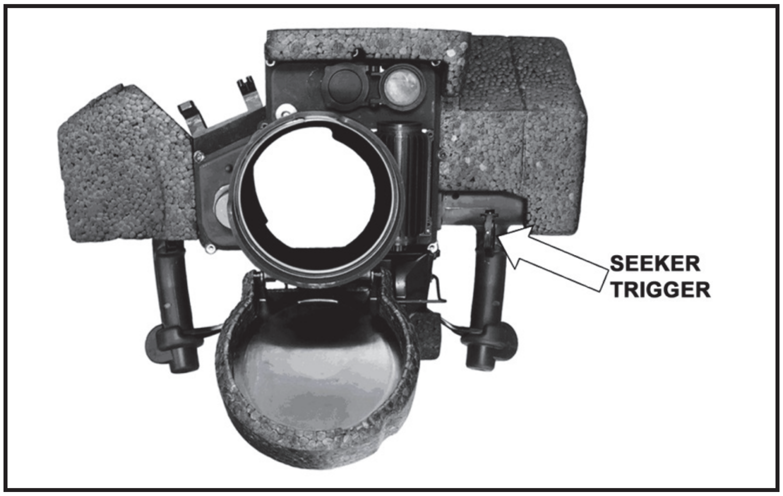


Figure 5-52. Seeker trigger.

Sight Select (SGT SEL) Switch

5-179. The SGT SEL switch (Figure 5-53) allows the gunner to toggle between the seeker FOV and the previous FOV (day FOV, WFOV, or NFOV). To return to the seeker FOV, the gunner squeezes and releases the seeker trigger.

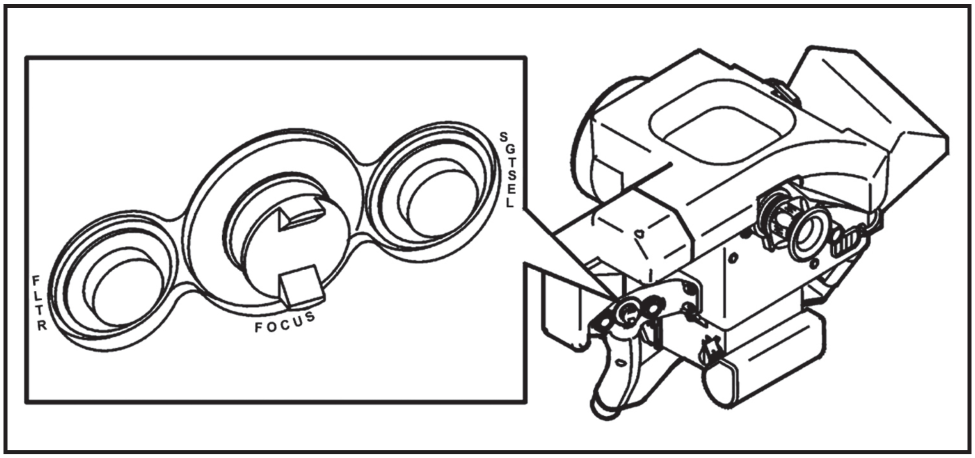

SGTSEL
FLTR
FOCUS

Figure 5-53. Sight select switch.

RIGHT HANDGRIP CONTROLS

5-180. The round controls on the right handgrip (Figure 5-54) include the ATTK SEL switch, the GATE ADJ/CTRS & BRT switch, and the fire trigger.

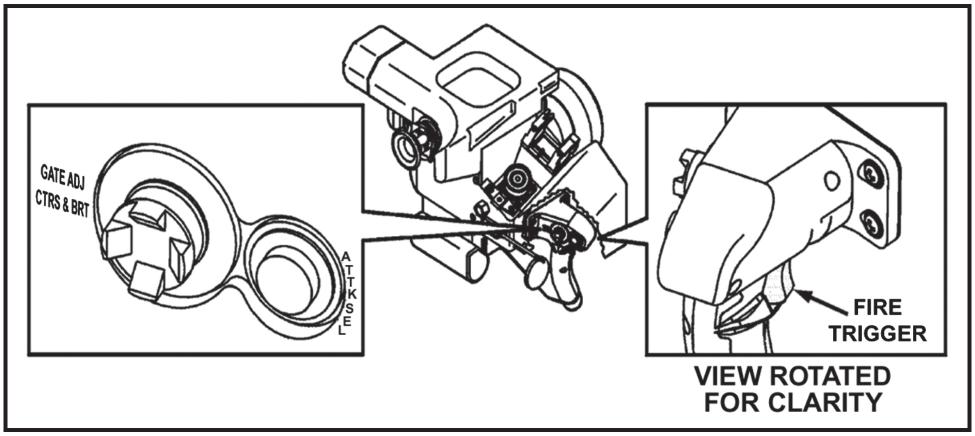

GATE ADJ
CTRS & BRT
ATTKSEL
FIRE
TRIGGER
VIEW ROTATED
FOR CLARITY

Figure 5-54. Right handgrip controls.

Attack Select (ATTK SEL) Switch

5-181. This pushbutton switch is located on the right side of the right handgrip (Figure 5-55). The gunner uses the ATTK SEL switch to select top or direct attack mode when in the seeker FOV.

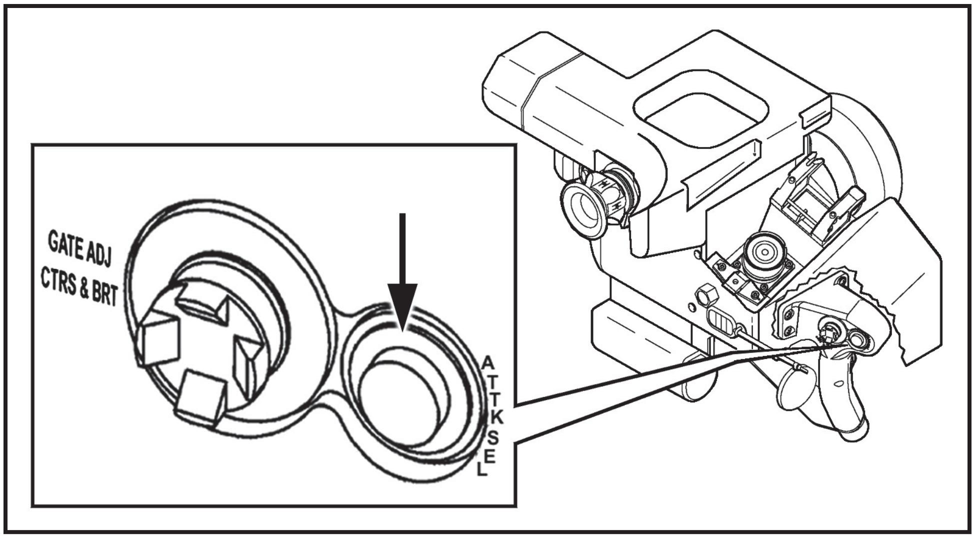


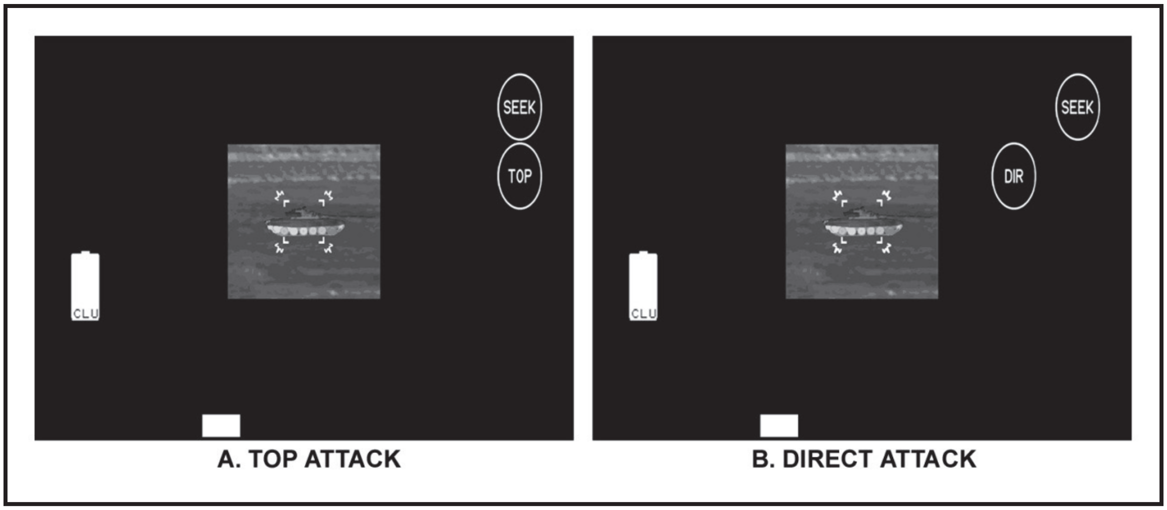
Figure 5-55. Attack select switch.

Top Attack Mode

5-182. Top attack is the default missile mode, as indicated by the TOP indicator on the CLU display (Figure 5-56A).

Direct Attack Mode

5-183. To select the direct attack mode, the gunner presses the ATTK SEL switch; the DIR indicator illuminates (Figure 5-56B). To toggle between the two missile attack modes, the gunner presses the ATTK SEL switch.



A. TOP ATTACK

B. DIRECT ATTACK

Figure 5-56. Missile mode indicators.

Gate Adjust/Contrast and Brightness (GATE ADJ/CTRS & BRT) Switch

5-184. The gunner uses the GATE ADJ/CTRS & BRT switch (Figure 5-57) to adjust the track gates in the seeker FOV.

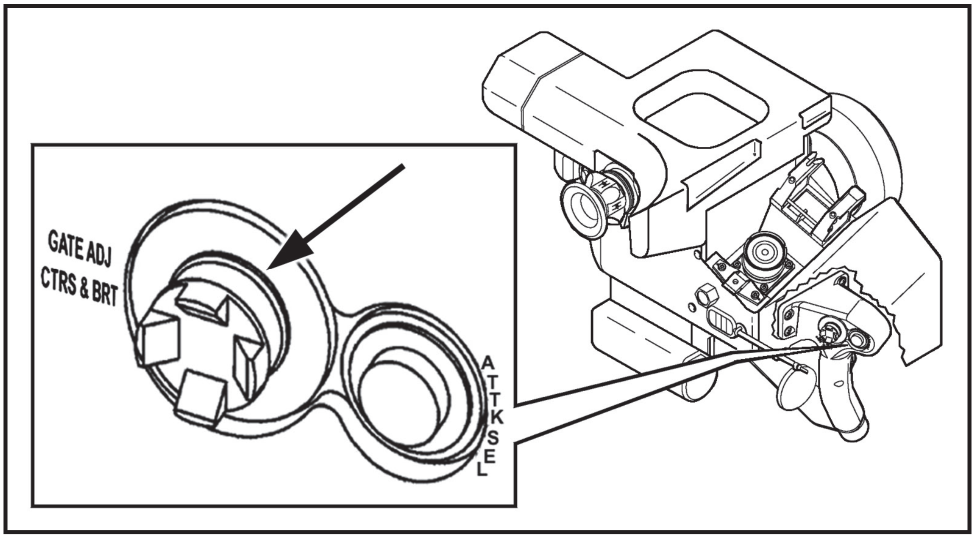


Figure 5-57. Gate adjust/contrast and brightness switch.

Down/Up Track Gate Adjustment

5-185. The gunner presses the GATE ADJ/CTRS & BRT switch down to decrease the height of the track gates and up to increase it (Figure 5-58).

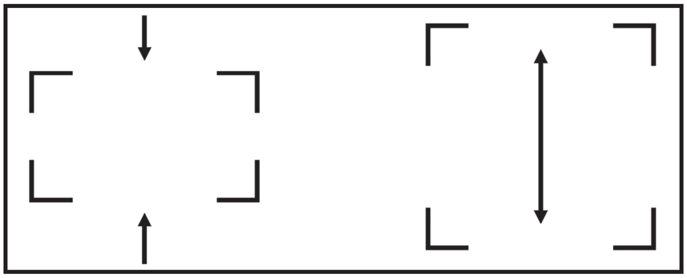


Figure 5-58. Track gate adjustment, down/up.

Left/Right Track Gate Adjustment

5-186. The gunner presses the GATE ADJ/CTRS & BRT switch left to decrease the width of the track gates and right to increase it (Figure 5-59).

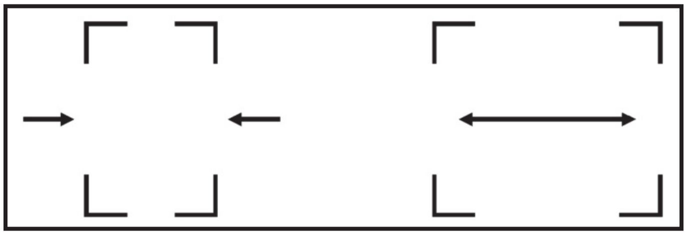


Figure 5-59. Track gate adjustment, left/right.

Fire Trigger

5-187. The fire trigger (Figure 5-60) is located on the right handgrip at the index finger position. When the seeker is locked onto the target, the gunner squeezes the fire trigger to launch the missile.

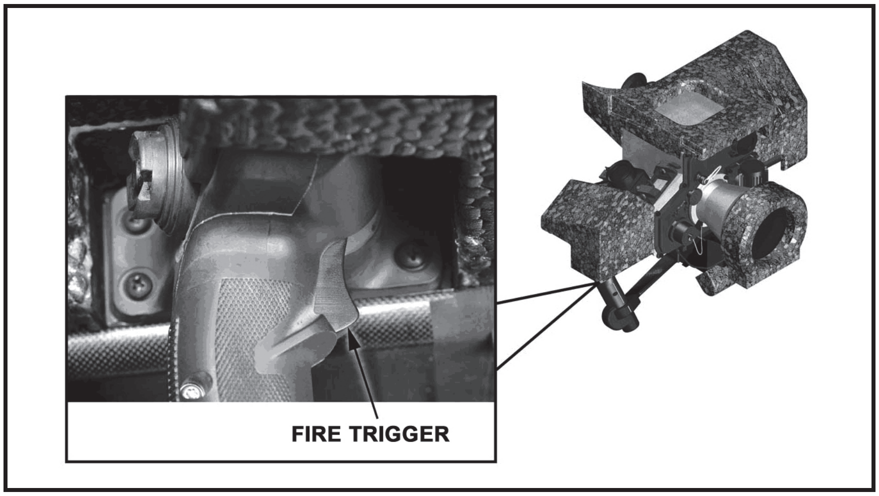


Figure 5-60. Fire trigger.

MANUAL RELEASE BUTTON

5-188. The manual release button (Figure 5-61) is located on the forward end cap. The gunner presses this button to equalize the air pressure between the forward end cap and the seeker dome to allow easy removal of the forward end cap.

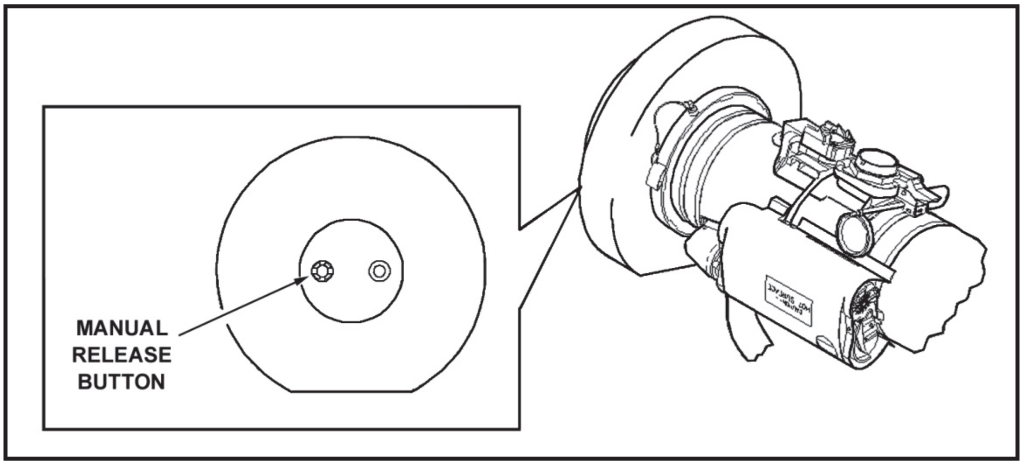


Figure 5-61. Manual release button.

ROUND INDICATORS

5-189. Round indictors consist of a—

- BCU status indicator.
- Humidity indicator.
- Seeker indicator.

CAUTION

The round BCU and humidity indicators should be checked before mating the round to the CLU.

BATTERY COOLANT UNIT STATUS INDICATOR

5-190. Located on the underside of the BCU, the BCU status indicator reflects the BCU's use. Prior to use, the spot on the indicator decal is blank. When the BCU has been activated, the center spot turns black (Figure 5-62).

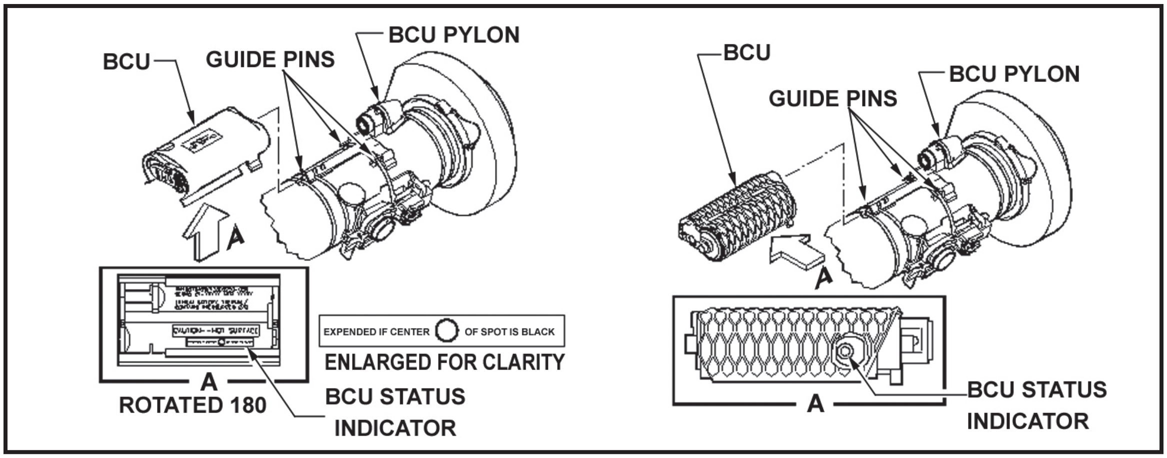

BCU
GUIDE PINS
BCU PYLON
A
A
ROTATED 180
EXPENDED IF CENTER OF SPOT IS BLACK
ENLARGED FOR CLARITY
BCU STATUS INDICATOR
BCU
GUIDE PINS
BCU PYLON
A
A
BCU STATUS INDICATOR

Figure 5-62. Battery coolant unit status indicator.

HUMIDITY INDICATOR

5-191. The round is equipped with a humidity indicator, located at the center of the forward end cap (Figure 5-63). The humidity indicator monitors moisture content of the round during storage.

NOTE: The humidity indicator does not determine the serviceability of the round. See the Javelin operator's manual for determining operational moisture levels.

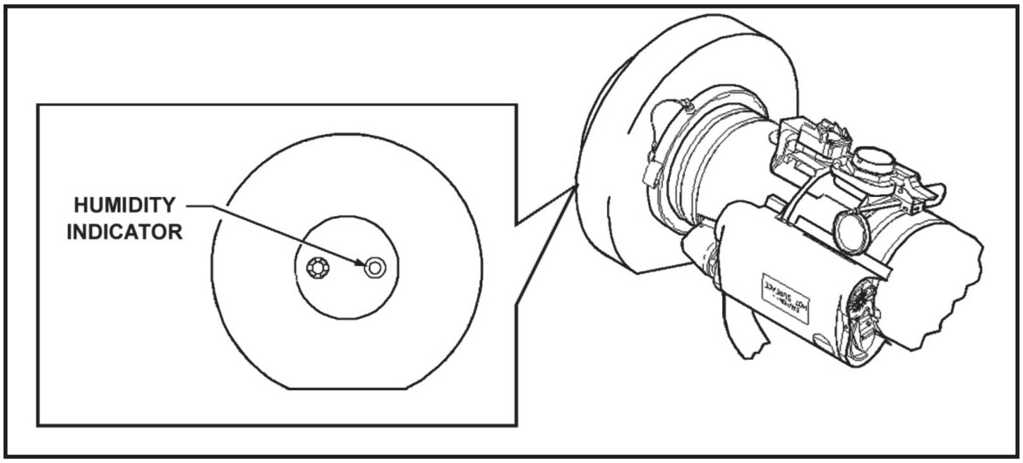

HUMIDITY INDICATOR

Figure 5-63. Humidity indicator.

SEEKER INDICATOR

5-192. The seeker indicator includes the—

- Track gates to lock the seeker onto a target
- Crosshairs the gunner must use to stay oriented with the target and to maintain tracking rate.

Track Gates

5-193. When the gunner activates the seeker, flashing track gates (Figure 5-64) appear in the CLU display to indicate that the seeker is active but not locked onto the target.

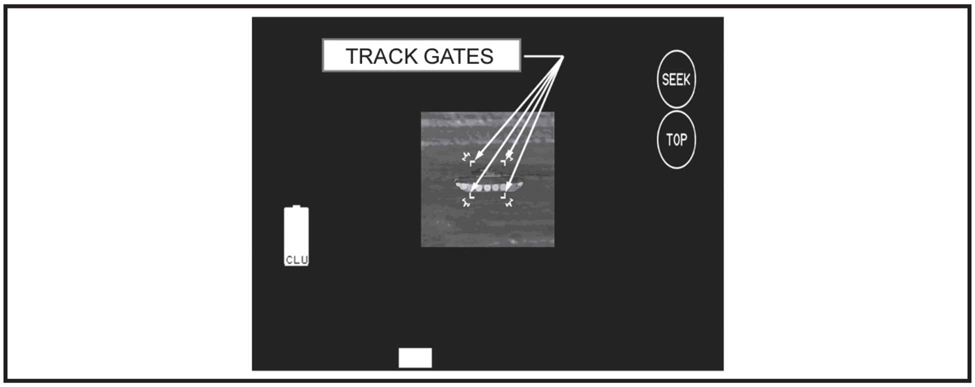


Figure 5-64. Flashing track gates.

Crosshairs

5-194. When the gunner engages and holds the seeker trigger, flashing crosshairs appear. After seeker lock-on, the track gates and crosshairs become solid (Figure 5-65).

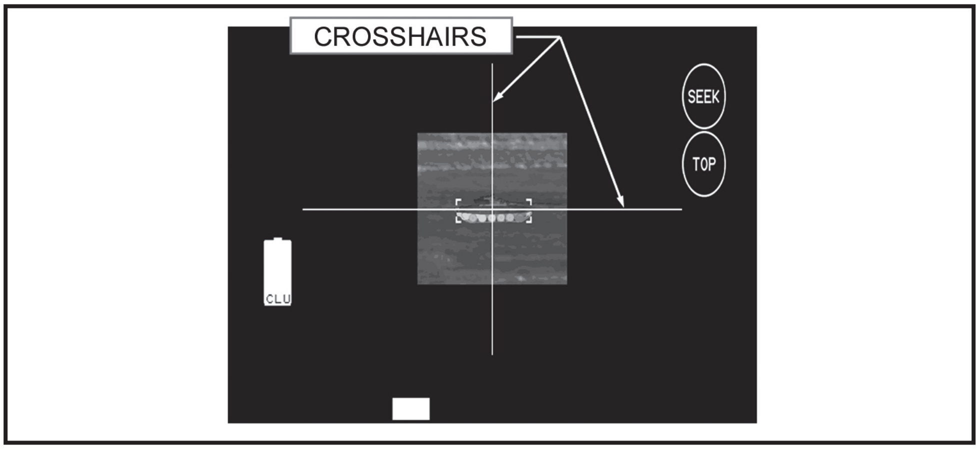


Figure 5-65. Solid track gates and crosshairs.

CAPABILITIES AND FEATURES

5-195. The Javelin can kill targets up to 2500 meters away. In addition, the missile has two selectable attack modes: top or direct. When in each mode, the missile travels a given flight path, or profile, to reach the target. When in each mode, the missile's exact profile depends on the range to the target (Figures 5-67 and 5-69), but the top attack mode also utilizes the missile's onboard software.

TOP ATTACK MODE

5-196. Top attack is the default missile mode. When in the top attack mode, the missile attacks the target from above, detonating on top of the target (Figure 5-66) to greatly increase the probability of a kill. This capability allows the gunner to attack a vehicle from a front, rear, or flank position. For example, armored vehicles generally have less protection on top. By attacking from above, the missile penetrates the vehicle and still has enough explosive force to cause extensive damage inside the vehicle.

NOTE: When attacking targets under protective structures, use the direct attack mode. Using the top attack mode may cause the missile to impact and detonate on the structure instead of the target.

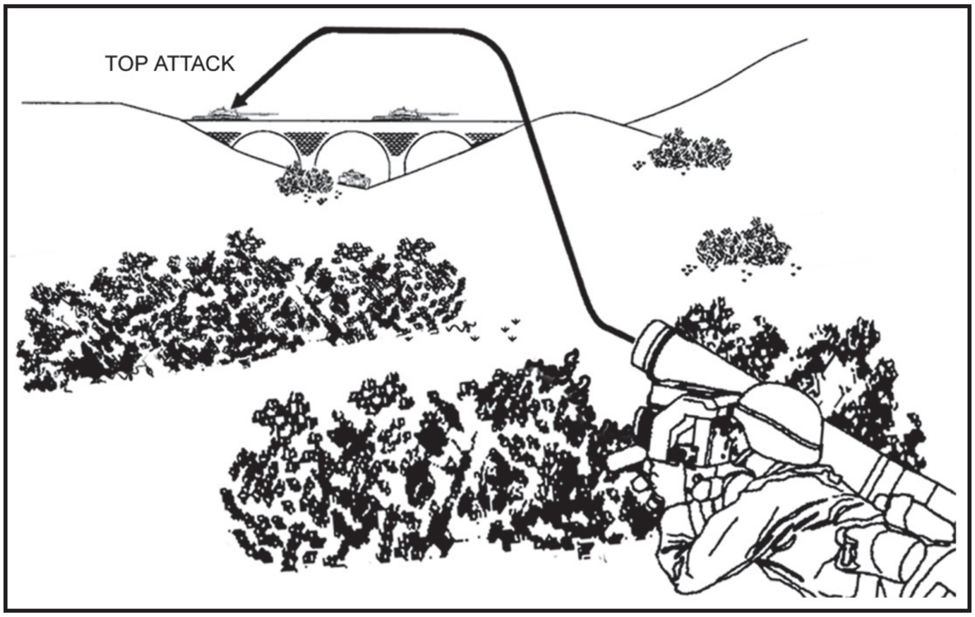


Figure 5-66. Top attack mode.

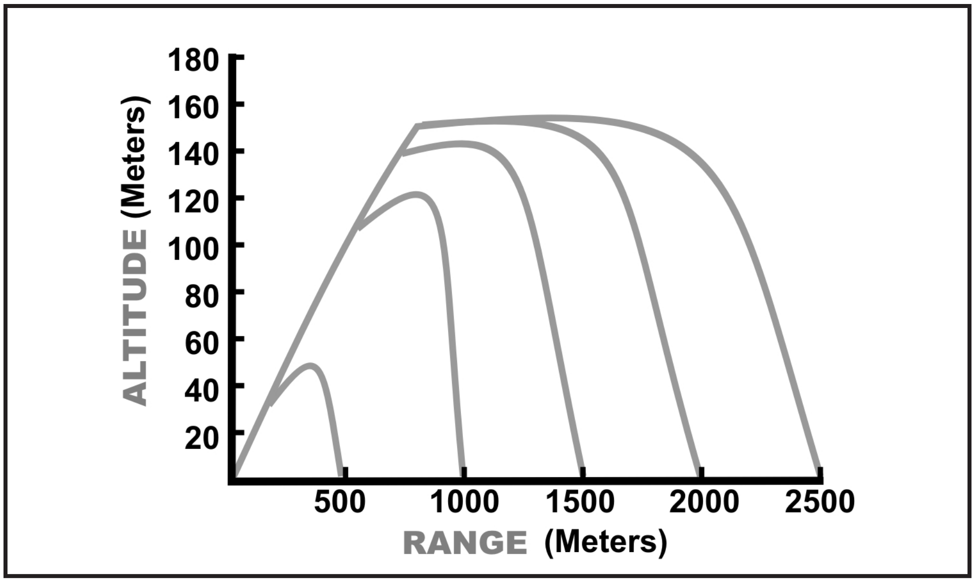


Figure 5-67. Top attack flight paths.

DIRECT ATTACK MODE

5-197. In the direct attack mode, the missile flies a more direct route from the gunner to the target vehicle, impacting and detonating on the side of the target. The direct attack mode of flight allows the missile to reach targets located under protective structures at a maximum range of 2500 meters (Figure 5-68). To select the direct attack mode, the gunner activates the seeker and presses the ATTK SEL switch located on the Javelin's right handgrip. As with the top attack mode, the exact profile of the missile flight path depends on range to the target (Figure 5-69).

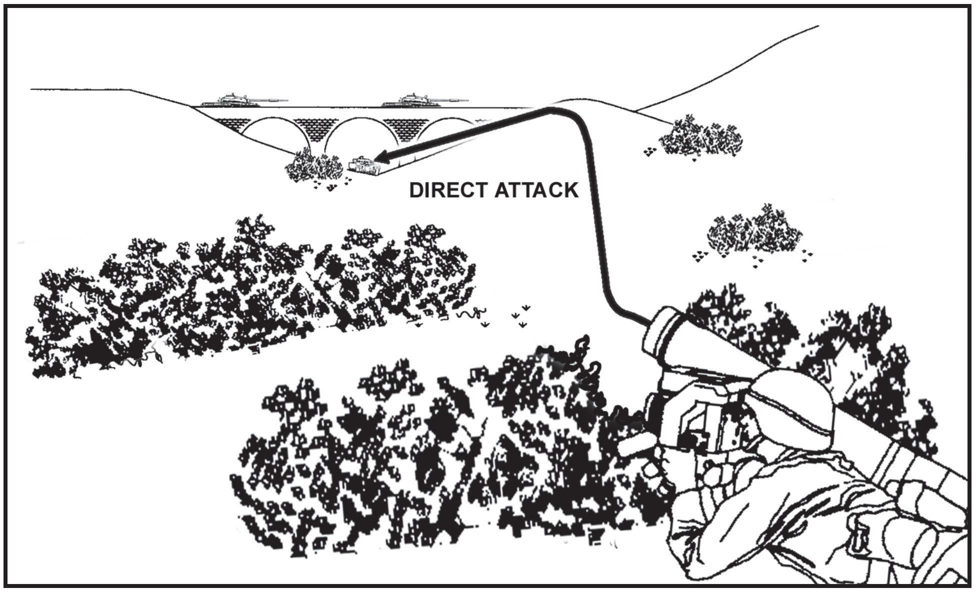


Figure 5-68. Direct attack mode.

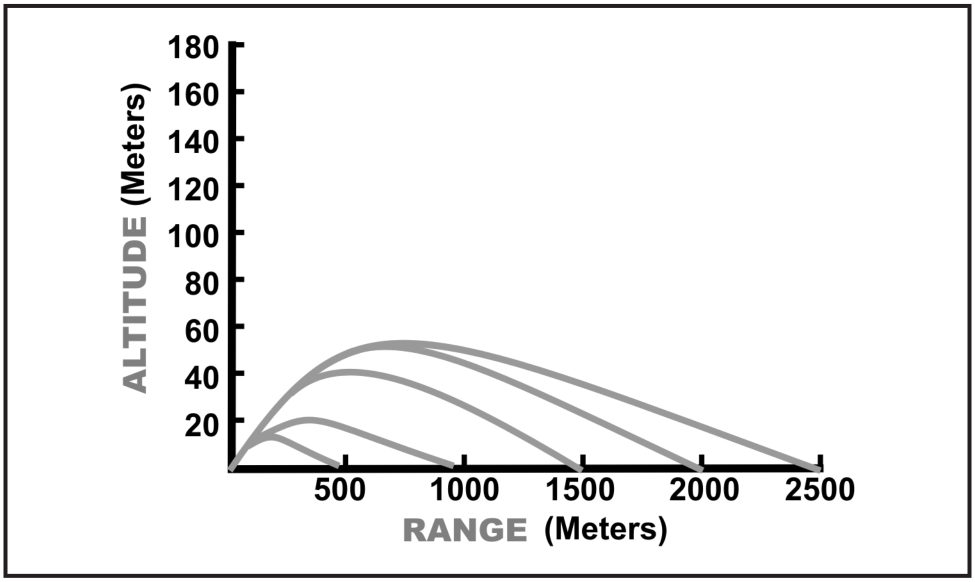


Figure 5-69. Direct attack flight paths.

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Appendix A

SAFETY

The hazards associated with Javelin operation include the backblast area, the laser eye-safe distance, the handling of the round, and the use of lithium batteries. This appendix provides units the necessary information to operate the Javelin missile system safely. To supplement this appendix, units should develop local directives and an SOP outlining safety requirements, individual responsibilities, equipment required for handling munitions, location and sequence of operations, protection of Soldiers, and clear designations and explanations of responsibilities for operations. Javelin training safety applies to all types of ranges and training sites.

BACKBLAST AREA

A-1. The Javelin produces backblast when the launch and flight motors fire. When the gunner fires the Javelin, it ignites a launch motor, creating a rearward blast that propels the missile approximately 15 feet from the launch tube. The flight motor ignites at this distance, propelling the missile to the target.

A-2. At launch, the Javelin has little recoil because the propellant gases escape to the rear of the weapon. This rearward blast can propel missile debris, and missile overpressure from the flight motor can cause ground debris. This backblast can damage equipment or seriously injure personnel who are too close to the rear of the LTA at the time of firing. Before the gunner launches the missile, he must ensure that no personnel are in the backblast area (at least 100 meters to the rear and 25 meters to the sides of the launcher). The 100-meter firing safe area is divided into a primary danger area and three caution areas, forming a 60-degree firing zone (Figure A-1).

PRIMARY DANGER AREA

A-3. The primary danger area (Figure A-1A) is a 60-degree sector, with its apex at the aft end of the missile launch motor. Its radius of curvature is 25 meters. A portion of the primary danger area extends to the firing line, covering an area 1 to 5 meters left and right of the launch tube centerline. During firing, personnel in this area may be seriously injured or killed.

CAUTION AREA 1

A-4. Caution Area 1 (Figure A-1A) extends radially (25 meters) from each side of the primary danger zone to the firing line. Injury can occur from launcher debris, and frequent exposure to the backblast in this area can cause serious hearing impairment or damage. Personnel should always wear approved hearing and eye protection when positioned in Area 1.

CAUTION AREA 2

A-5. Caution Area 2 (Figure A-1A) extends radially (35 meters) from each side of the primary danger zone to the firing line. Injury can occur from launcher debris and loose impediments dislodged during launch motor ignition. Exposure to the backblast in the area 10 meters beyond the primary danger zone can cause hearing impairment and eye damage. Personnel should always wear approved hearing and eye protection when positioned in Area 2.

CAUTION AREA 3

A-6. Caution Area 3 (Figure A-1A), a 100-meter radius aft of the launcher and within the 60-degree sector, is affected by the activation of the missile flight motor. Caution Area 3 extends to the rear of the primary danger zone. Exposure to the backblast in the area 10 meters beyond the primary danger zone can cause hearing impairment and eye damage. Personnel should always wear approved hearing and eye protection when positioned in Area 3.

AREA A

A-7. Area A is 500 meters at its widest point for warhead rounds and 200 meters for inert rounds. Area A is measured from the launch point extending 850 meters downrange (Figure A-1B). At this point downrange, the flight motor is fully expended. The remaining downrange portion of Area A tapers down to a 200-meter width for warhead rounds and 100-meter width for inert rounds at the maximum range of 4,000 meters. The size of Area A was selected to contain missile and warhead debris from impacts on the boundary and also contain portions of the missile that remain attached to the propulsion section, which may continue to be propelled until flight motor burnout.

AREA B

A-8. Area B contains the debris scatter associated with missile landing at the forward edge of the impact area. This area measures 500 meters deep and about 1,880 meters wide (Figure A-1A).

AREA F

A-9. The launcher danger zone (Area F) is the zone aft of the launch tube. Debris, heat, and noise hazards are the major concerns within this area. Figure A-1B identifies the launcher danger zone and related dimensions for normal missile firings.

ROUND HANDLING

A-10. Improper or careless handling of the Javelin round can damage its components and cause the missile to malfunction when launched. If the gunner notices any sign that the round may have been dropped or if the round is deformed or fractured, the gunner notifies his supervisor immediately and follows proper handling procedures IAW TM 9-1425-688-12 and TM 9-1300-206.

FIRING FROM ENCLOSURES

A-11. The Javelin has a soft launch system, allowing it to be fired safely from inside of a building, provided that the room is at least 7 feet high, 12 feet wide, and 15 feet deep. Before firing the Javelin from inside of a building, the following precautions must be taken:

- Remove debris and loose objects from behind the launch site. The backblast and overpressure can scatter loose objects, and escaping gases from the missile's first-stage motor are hot and flammable, causing rugs, furniture, and curtains to catch fire. When possible, keep a fire extinguisher nearby.
- When possible, open all doors and windows within the launch area to allow the backblast and overpressure to escape.
- All personnel within 25 meters of the Javelin must wear hearing protection.
- Use the CLU face shield to protect the gunner's face. It is possible to damage the face shield absorber between the indentation and the CLU main housing. If this part of the face shield is missing, the gunner must switch from firing the Javelin with the right eye to the left eye.

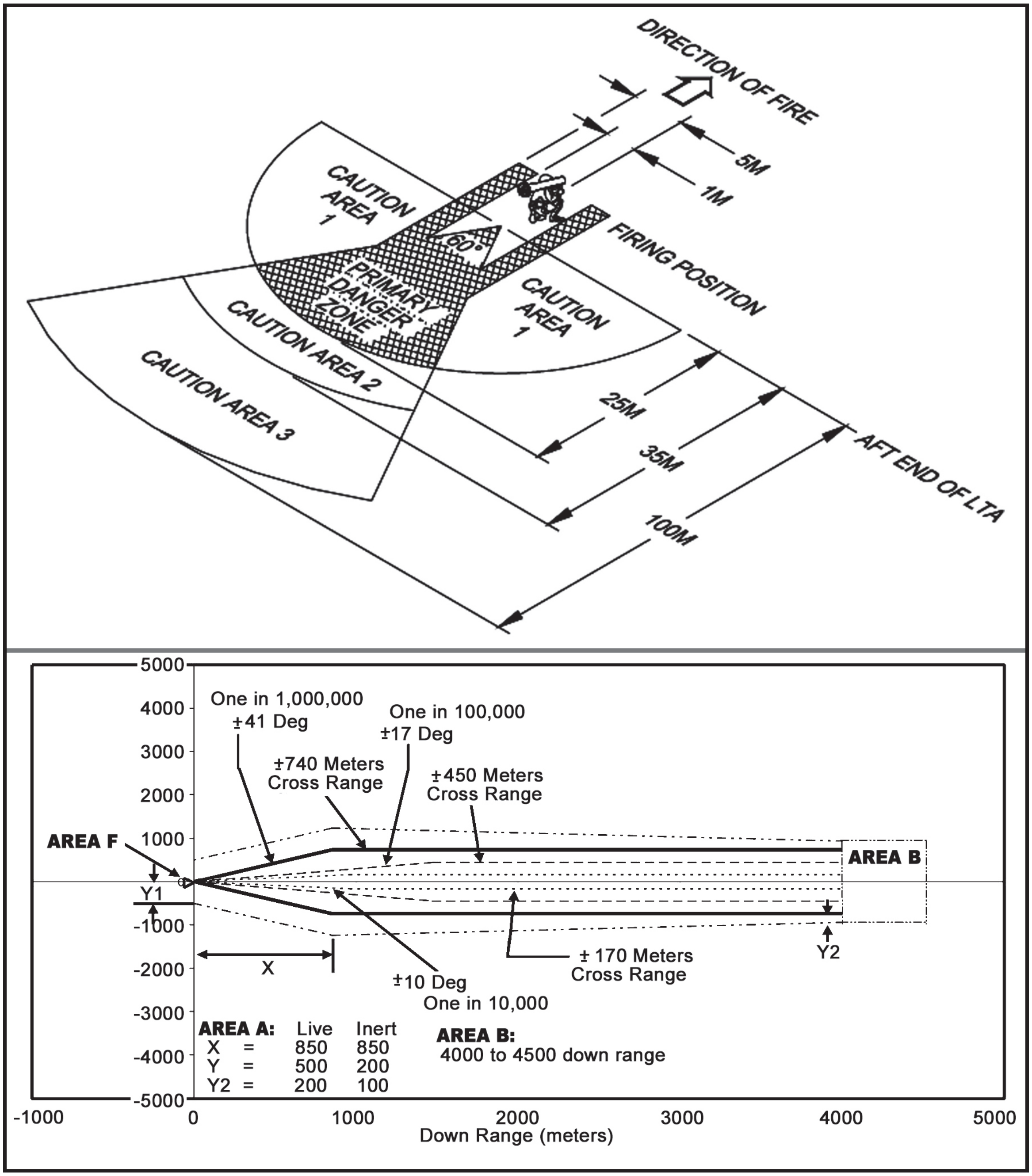
DIRECTION OF FIRE
5M
1M
FIRING POSITION
CAUTION AREA 1
60°
PRIMARY DANGER ZONE
CAUTION AREA 1
CAUTION AREA 2
CAUTION AREA 3
25M
35M
100M
AFT END OF LTA
One in 1,000,000
±41 Deg
One in 100,000
±17 Deg
±740 Meters Cross Range
±450 Meters Cross Range
AREA F
Y1
AREA B
X
±10 Deg
One in 10,000
± 170 Meters Cross Range
Y2
AREA A: Live Inert
X = 850 850
Y = 500 200
Y2 = 200 100
AREA B:
4000 to 4500 down range
5000
4000
3000
2000
1000
-1000
-2000
-3000
-4000
-5000
-1000
0
1000
2000
3000
4000
5000
Down Range (meters)

Figure A-1. Javelin backblast area and surface danger zone.

FIGHTING POSITION

A-12. When firing from either a hasty or improved fighting position, the gunner must take into consideration obstructions directly to his front, to his rear, and to the sides of the fighting position.

NOTE: For more information on fighting positions, see Chapter 4.

SAFETY PRECAUTIONS FOR THE MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM

A-13. Avoid direct eye exposure to MILES laser radiation. The MILES laser is classified as a Class 3A laser. Do not point the MILES laser at personnel within 49 feet with the unaided eye or 98 feet with the aided eye (binoculars, laser range finders, etc.) (Figure A-2). Personnel within the beam path must wear eye protection, since direct exposure to the laser radiation or reflection from the beam could cause serious eye injury. If eye exposure to laser radiation is evident, seek medical attention immediately.

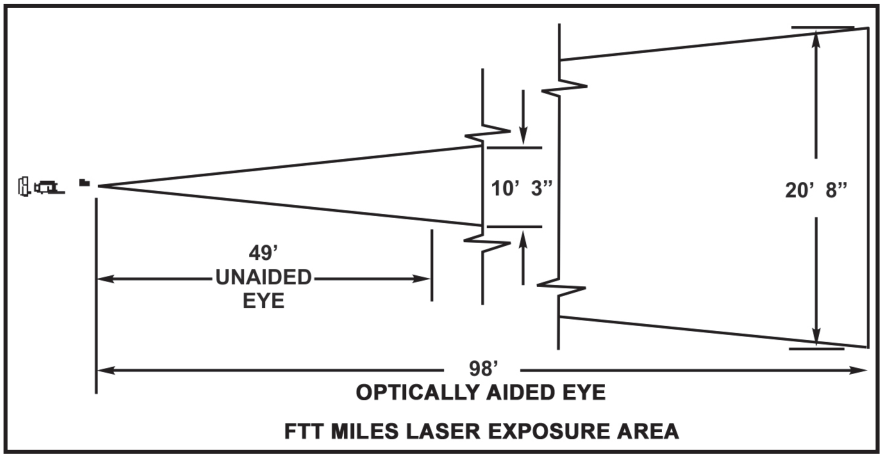

Figure A-2. Laser-safe eye distance.

SAFETY PRECAUTIONS FOR THE BATTERY COOLANT UNIT

A-14. Observe the following safety precautions when handling the BCU:

HEAT

A-15. Avoid skin contact with the BCU. The BCU can produce enough heat to cause serious burns. If you experience burns from accidental contact with the BCU, seek medical attention immediately.

HAZARDOUS WASTE

A-16. The BCU battery and the BA5590/U battery (Figure A-3) contain a lithium-alloy thermal material considered to be hazardous waste. Disposal of these batteries after use must be IAW TM 43-0003-44.

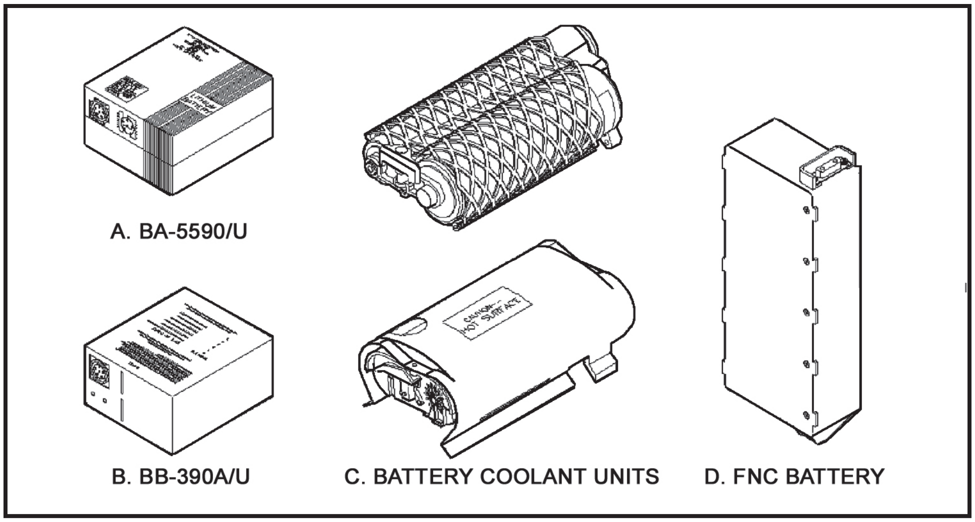

Figure A-3. Javelin weapon system batteries.

SAFETY PRECAUTIONS FOR LIVE ROUNDS

A-17. Observe the following safety precautions when experiencing a weapon malfunction (misfire/hangfire) during target engagement. See Appendix D for more information about recognizing misfire/hangfire symptoms and corrective actions.

MISFIRE

A-18. Once a round is declared a misfire and will not launch, the gunner notifies his supervisor immediately. Then, he removes the CLU from the round and places the round 25 meters from the firing position, keeping the round's nose pointed downrange.

HANGFIRE

A-19. Once a round is declared a hangfire and will not launch, the gunner notifies his supervisor immediately. Then, he removes the CLU from the round and places the round 25 meters from the firing position, keeping the round's nose pointed downrange.

RISK MANAGEMENT

A-20. Risk management involves—

- Identifying and assessing hazards.
- Developing controls and making decisions.
- Implementing controls.
- Supervising and evaluating training.

A-21. The risk planning process is continuous; it is performed for long-, short-, and near-term training.

ACCIDENT REPORTING

A-22. Report accidents involving injury to personnel or damage to materiel on DA Form 285 (Technical Report of U.S. Army Ground Accident) IAW AR 385-10. Report explosives and ammunition malfunctions IAW AR 75-1.

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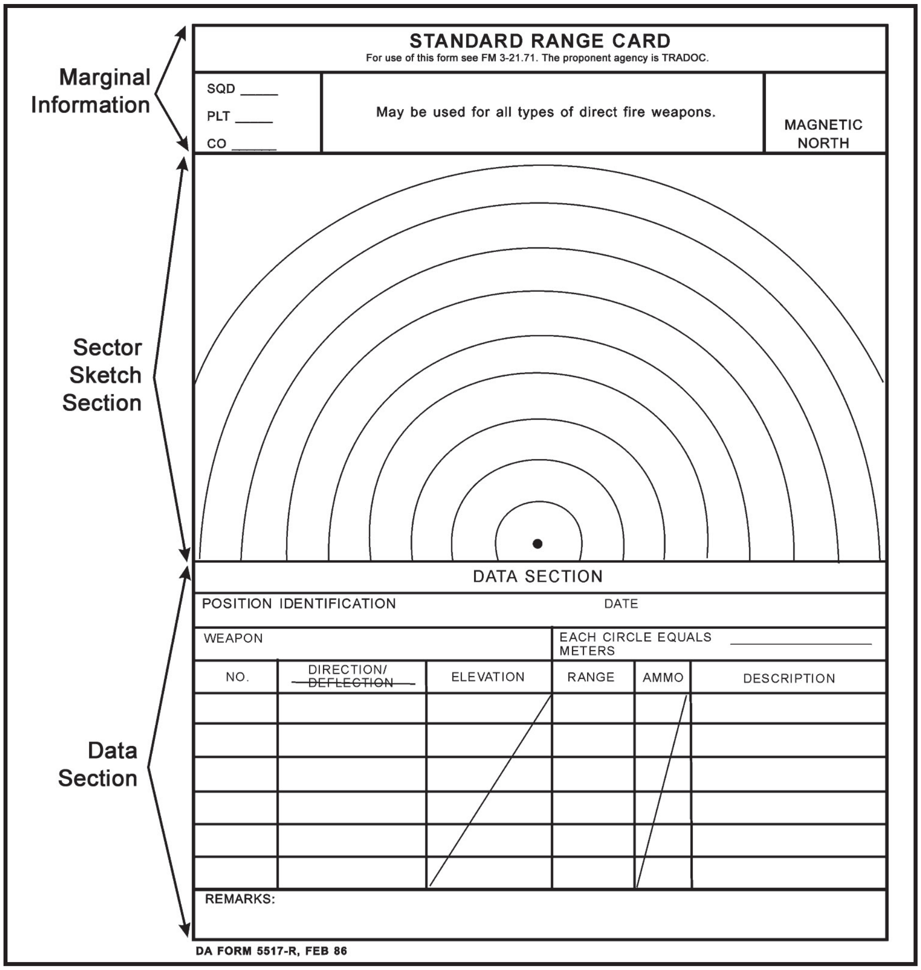
Appendix B

STANDARD RANGE CARD

This appendix outlines the processes involved in preparing a range card. Gunners use the standard range card, slightly modified for use with the Javelin medium close combat missile system. The range card is a sketch of the Javelin's emplacement within the platoon's assigned sector of fire. It contains information that helps in planning and controlling platoon fires, in detecting and engaging targets, and in orienting replacement personnel. Using range cards allows a Javelin gunner or replacement gunner to find and engage targets quickly.

DESCRIPTION

B-1. DA Form 5517-R (Standard Range Card (LRA) (Figure B-1) is a record of the firing data for a weapon system on a given sector of fire. This record facilitates target engagement during good or limited visibility conditions. It is divided into three sections: marginal information, sector sketch section, and data section.


Marginal Information
Sector Sketch Section
Data Section

STANDARD RANGE CARD

For use of this form see FM 3-21.71. The proponent agency is TRADOC.

SQD _____
PLT _____
CO ______

May be used for all types of direct fire weapons.

MAGNETIC NORTH

DATA SECTION

POSITION IDENTIFICATION

DATE

WEAPON

EACH CIRCLE EQUALS ______________ METERS

NO.	DIRECTION/ ~~DEFLECTION~~	ELEVATION	RANGE	AMMO	DESCRIPTION

REMARKS:

DA FORM 5517-R, FEB 86

Figure B-1. Example of DA Form 5517-R.

GENERAL PROCEDURES

B-2. Before a gunner can prepare a range card, the leader must brief the gunner on (Figure B-2)—

- Firing position.
- Left and right limits of fire.
- Maximum engagement line (MEL).
- AAs.
- TRPs.

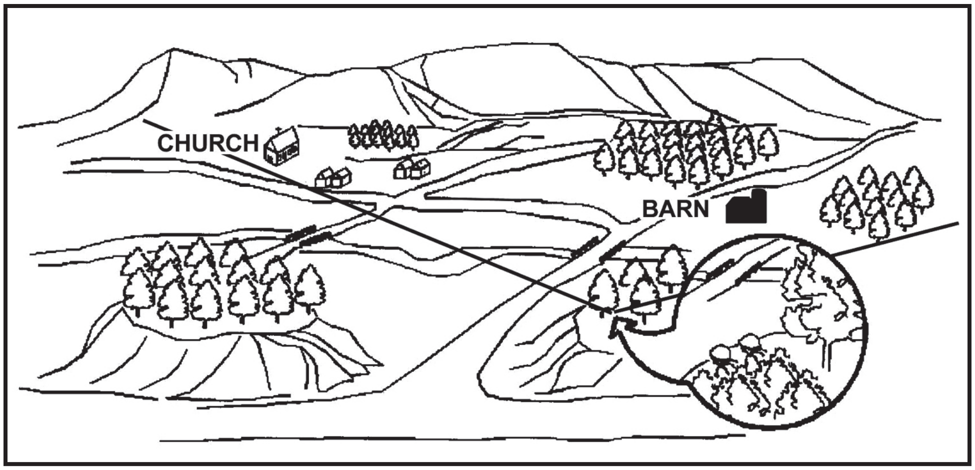


Figure B-2. Gunner's sector of fire.

Example of a Section Leader Briefing a Gunner

"I want you to cover a sector of fire that begins here, at your firing position, and goes to a point about 500 meters beyond that church on the left; moves to the right along the high ground at 200 meters behind the houses; through the woodline; behind the hill, barn, and orchard, until it reaches a point about 300 meters beyond the right leading edge of the orchard; and returns to your firing position. The enemy is approaching from the north, so they will probably use those two roads to enter your sector. Plan to engage the enemy's armor as soon as they come within range on the road behind the barn and orchard. Engage the enemy targets as soon as they appear on the second road, as they approach from the left side of that large hill. There are two TRPs within your sector, so copy them down: the church is TRP AB1670, and the barn is TRP AB1677."

MARGINAL INFORMATION

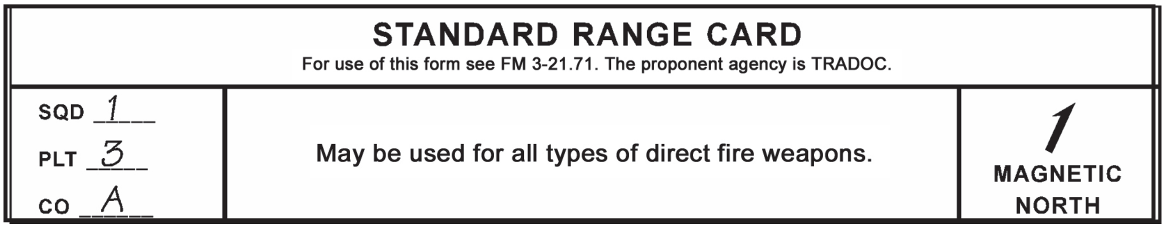
B-3. Use the following procedures to complete the marginal information at the top of the range card (Figure B-3).

MAGNETIC NORTH

B-4. Take the range card and orient it with the assigned sector of fire. Use a lensatic compass to determine magnetic north. Keep the range card oriented to the sector of fire and draw the magnetic north symbol in the appropriate direction in the Magnetic North box.

UNIT DESCRIPTION

B-5. Use squad, platoon, and company designations. Do not list any designation for units higher than company level (Figure B-3).



STANDARD RANGE CARD

For use of this form see FM 3-21.71. The proponent agency is TRADOC.

SQD 1

PLT 3

CO A

May be used for all types of direct fire weapons.

MAGNETIC NORTH

Figure B-3. Marginal information.

CALCULATE

B-6. Determine maximum engagement line (MEL) distances (EACH CIRCLE EQUALS _________ METERS).

NOTE: Remember, the Javelin's maximum effective range is 2,000 meters.

---

(1) Using a map or leader-provided range data, determine the farthest point from the designated firing position to the MEL.
(2) Divide the distance into 9, the number of circles on a range card.
(3) Round the results to the nearest 10 meters.
(4) Enter this number into the data section.

Examples

If the distance to the farthest point from the designated firing position to the MEL is 2,000 meters, then 9 intervals into 2,000 meters = 222 meters. Round 222 to 220. Therefore, each circle equals 220 meters (Figure B-4).

If the distance to the farthest point from the designated firing position to the MEL is 1,500 meters, then 9 intervals into 1,500 meters = 166.667 meters. Round 166.667 to 170. Therefore, each circle equals 170 meters.

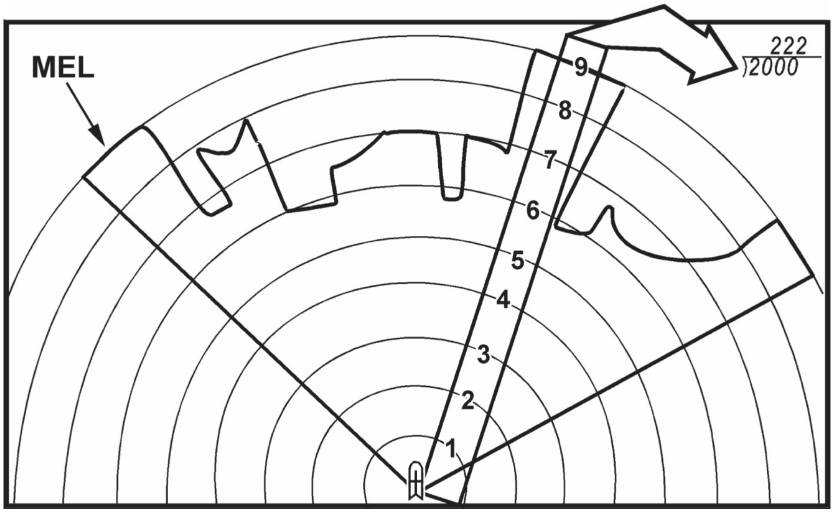


Figure B-4. Determination of distance between circles.

SECTOR SKETCH SECTION DEVELOPMENT

B-7. The sector sketch section is a graphic representation of a gunner's sector of fire (Figure B-5). The sector sketch of the terrain should be a good representation since it becomes vital during periods of limited visibility.

NOTE: A gunner may be assigned more than one sector of fire. A separate range card is prepared for each sector.

SKETCHES

B-8. The sketch should cover the entire assigned sector if possible. Make the sketch as large as possible, but do not exceed the limits of the largest circle. When depicting large natural objects (forests, hills, and so forth) or man-made objects (buildings, bridges, and so forth), draw the outline of the object and label it appropriately (Figure B-5). When sketching objects in the sector, locate them on or near the corresponding circle to denote range to the object.

NOTE: Do not attempt to depict contour lines on the sector sketch section.

GUNNER'S FIRING POSITION

B-9. The gunner's firing position is designated by the black dot in the center of the smallest circle of the range card. Draw a symbol of the Javelin over the black dot to designate that this range card is for a Javelin.

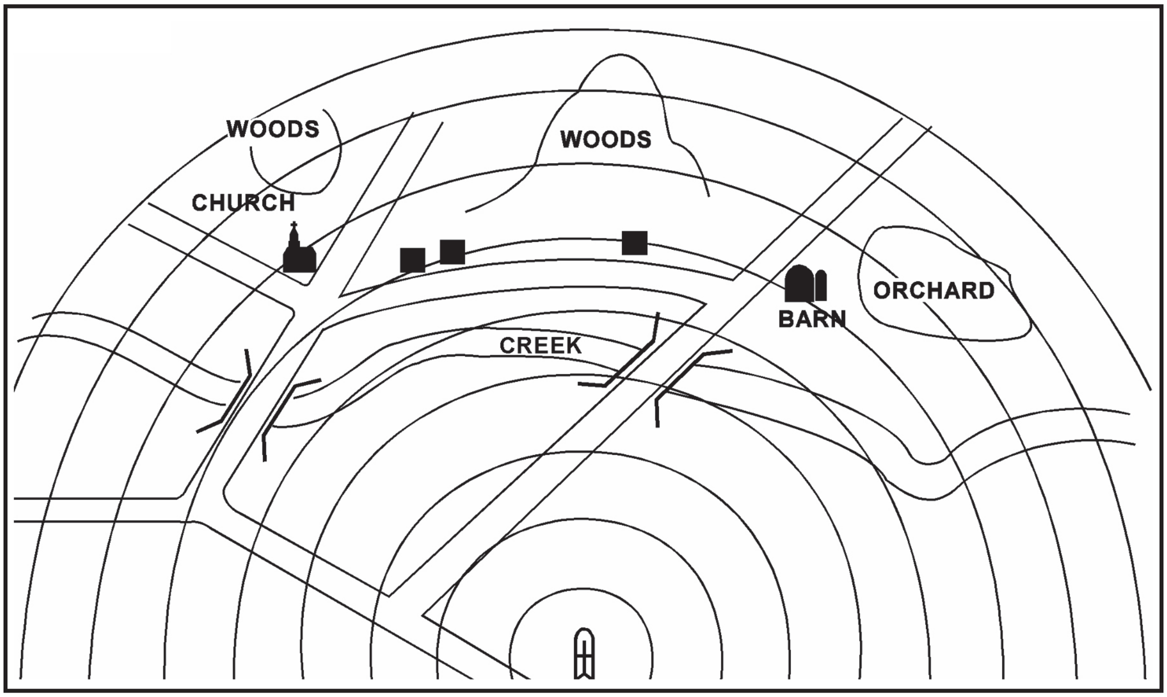


Figure B-5. Sector sketch.

LEFT AND RIGHT LIMITS

B-10. Left and right limits are imaginary lines from the gunner's firing position to a designated point on the ground (Figure B-6). Use terrain features when possible to designate left and right limits. Other recognizable objects such as a building or other man-made structures can be used. The area between the left and right limits depicts the gunner's sector of fire or area of responsibility. Lines are drawn from the designated firing position to the MEL in the area of the designated limits. Number the left limit as No. 1, number the right limit No. 2, and place a circle around each number. Record the azimuth and distance of each limit in the data section.

MAXIMUM ENGAGEMENT LINE

B-11. The MEL designates the maximum effective range of a weapon (Javelin) and the gunner's line-of-sight limitations due to the terrain in his given sector of fire (Figure B-6).

- If there are no limitations, draw the MEL along the last circle in the sector sketch section. The line should connect with the left and right limit labels.
- If there are limitations, starting at the left limit, draw the MEL in front of the limiting terrain features. The MEL should extend in front of and follow the limitations until it reaches the right limit.

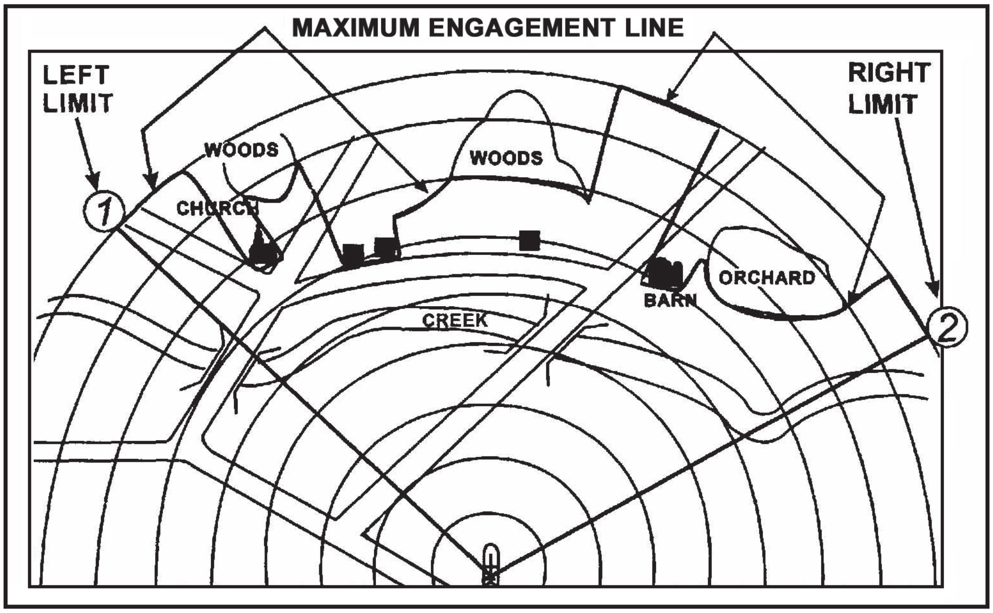

MAXIMUM ENGAGEMENT LINE
LEFT LIMIT
RIGHT LIMIT
WOODS
WOODS
CHURCH
ORCHARD
BARN
CREEK
1
2

Figure B-6. Sector of fire and maximum engagement line.

AVENUES OF APPROACH

B-12. AAs are areas where a target is most likely to appear or most likely to travel. This area can be a natural line of drift or a road. Tracked and wheeled vehicles may or may not use the same AA. Starting from the left and working to the right, number the areas where targets are likely to appear. Start with the number three since the numbers one and two have already been used to mark the left and right limits. Place a circle around each number. Continue until all identified AAs have an assigned number (Figure B-7). Record the azimuth and distance to each AA in the data section.

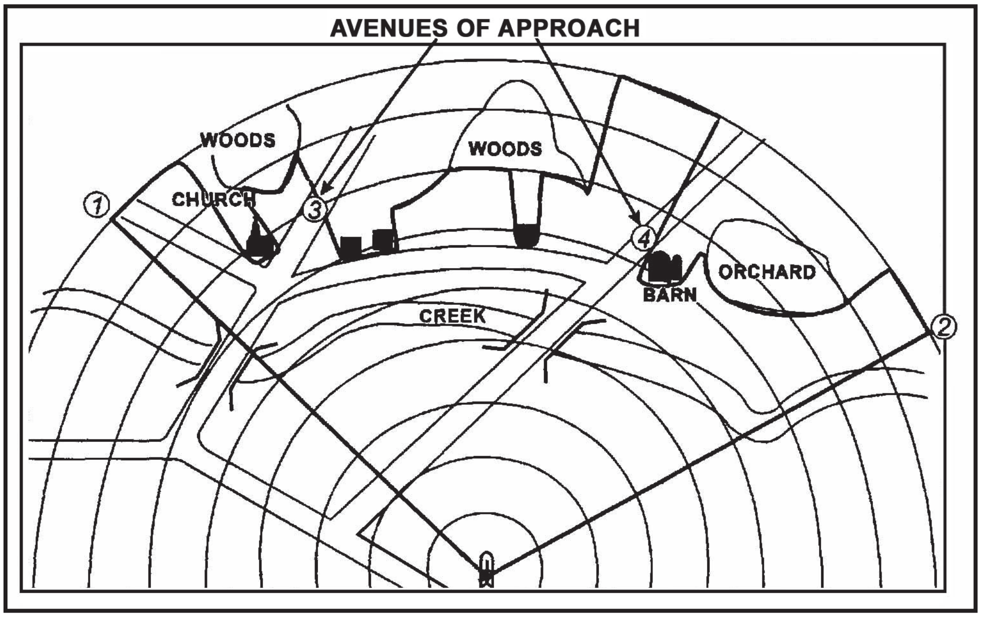

AVENUES OF APPROACH
WOODS
WOODS
CHURCH
ORCHARD
BARN
CREEK
1
3
4
2

Figure B-7. Avenues of approach.

TARGET REFERENCE POINTS

B-13. Prominent terrain features and or easily recognizable man-made objects (for example, road intersections, buildings, bridges, and so forth) are used as TRPs (Figure B-8). TRPs are used to locate targets and adjust direct or indirect fires. Normally, the sector has at least one TRP in a sector, but no more than three. Number each TRP and place a circle around each number starting with the next available number after AA numbers. In Figure B-8, there are two AAs and two TRPs, numbers 5 and 6 are assigned to the TRPs for this example. Record the azimuth and distance to each TRP in the data section.

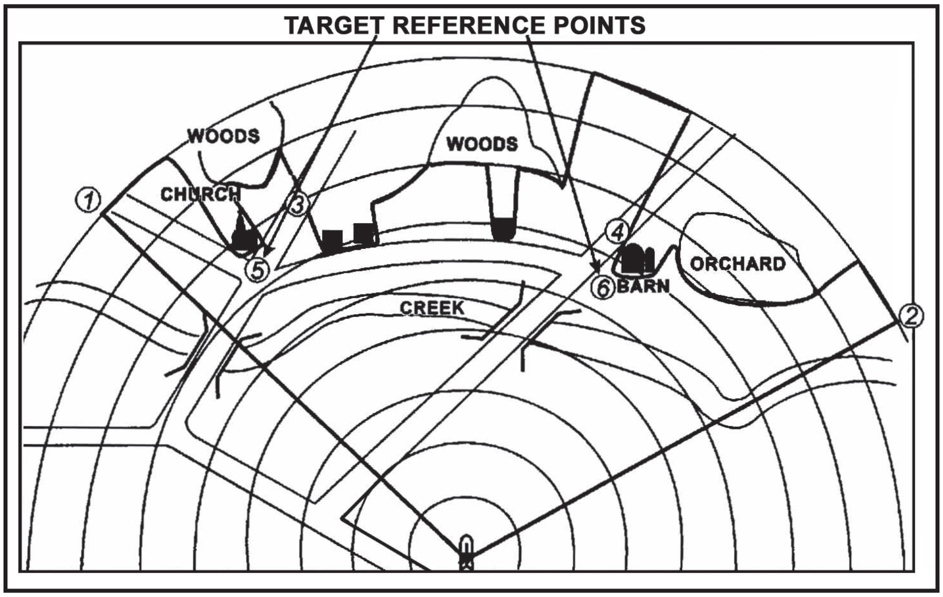


Figure B-8. Target reference points.

DEAD SPACE

B-14. Dead space is an area inside a gunner's sector of fire and inside the range of his weapon system where he can neither observe nor place direct fire. Any area in which a gunner does not have line of sight is considered dead space (Figure B-9). Buildings, trees, hills, or other terrain features can cause dead space. Shade these areas using diagonal lines to indicate significant dead space in the sector. These areas can then be identified as areas for indirect fire weapons.

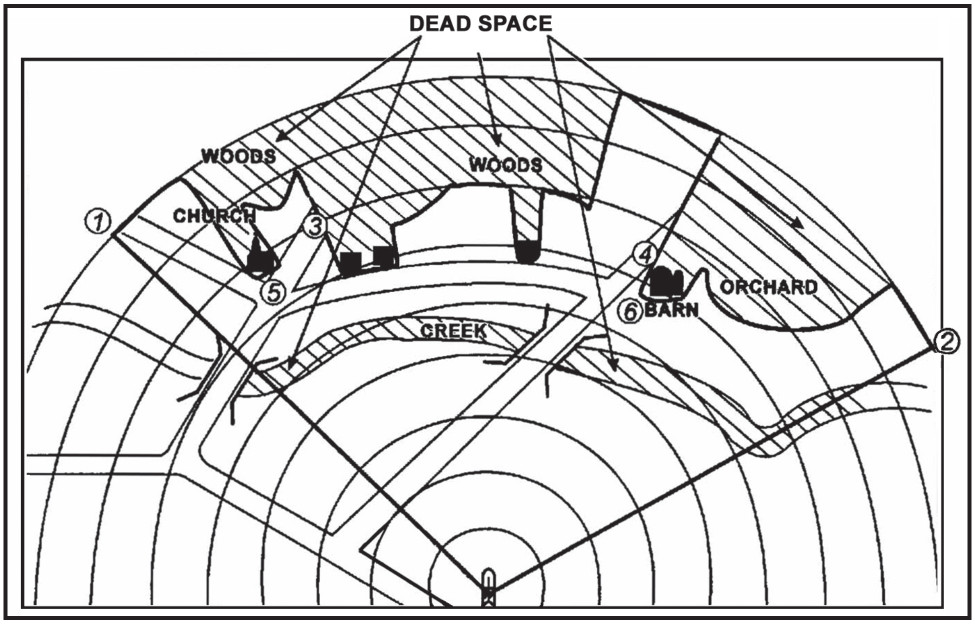


Figure B-9. Dead space.

GUNNER'S REFERENCE POINT

B-15. The gunner's reference point (GRP) serves as a point of reference when one unit is being replaced by another (Figure B-10). The gunner locates a nearby recognizable terrain feature (such as hilltop, road junction, and so forth) to the right, left, or rear of his firing position to use as his GRP. Label the GRP and draw an arrow between it and the firing position to the terrain feature. The direction of the arrow determines which azimuth to use. Record the azimuth and distance in the data section.

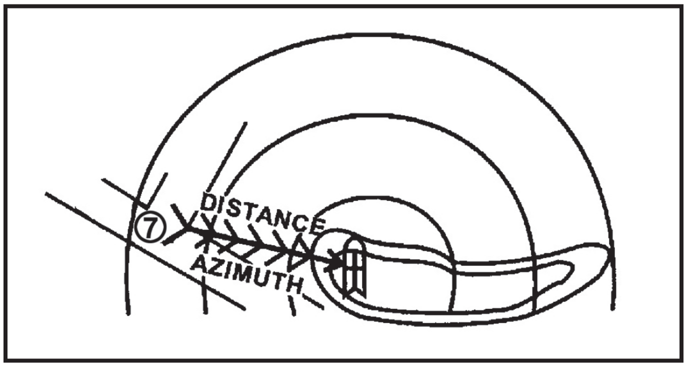


Figure B-10. Gunner's reference point and firing.

DATA SECTION

B-16. Fill in the DATA SECTION (Figure B-11) as follows. Figure B-12 shows a sample completed range card for a Javelin position:

(1) POSITION IDENTIFICATION: Designate as either primary, alternate, or supplementary.
(2) DATE: Indicate only the day and month.
(3) WEAPON: Enter Javelin.
(4) NO. (number):Use the numbers 1 and 2 to represent the left and right limits. Starting with the subsequent numbers designate s and then TRPs as designated in the sector sketch section.

(5) DIRECTION/DEFLECTION: List only the DIRECTION, in degrees for the appropriate item in the number (NO.) column. Line through the word DEFLECTION since it is not applicable.

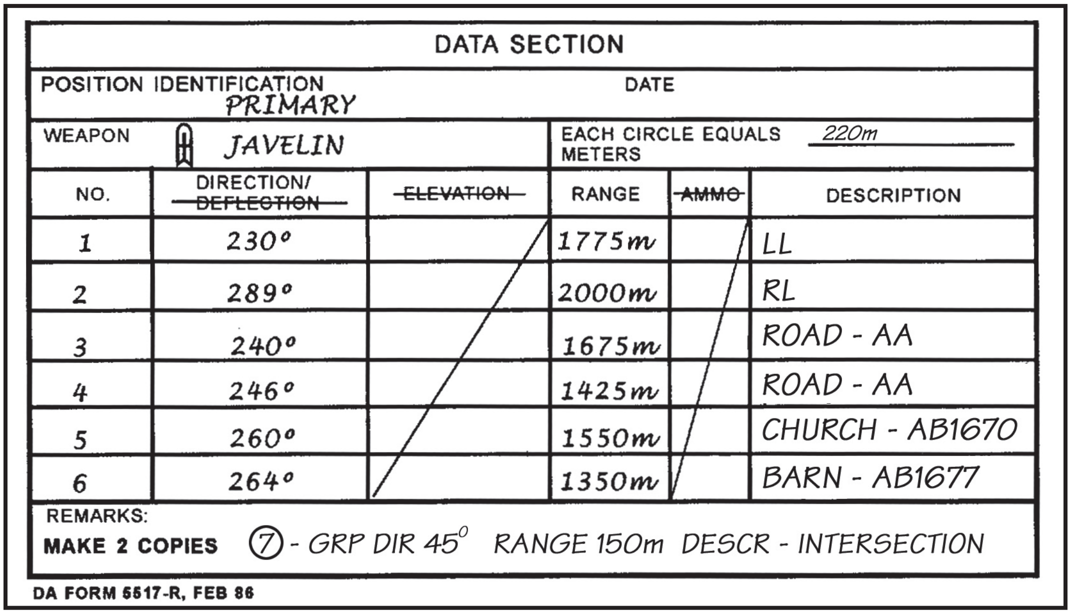
(6) ELEVATION: Line through the word ELEVATION since it is not applicable. Draw a diagonal line through the boxes pertaining to ELEVATION.

(7) RANGE: Distance is measured in meters from the designated firing position to the target or target engagement area. The most accurate way to measure distance is the laser range finder.

(8) AMMO: Line through the word AMMO since it is not applicable. Draw a diagonal line through the columns pertaining to AMMO.

(9) DESCRIPTION: List the name of the item listed in the corresponding NO. column (for example, road intersection, barn, church, and so forth). If the object is a TRP, list the TRP number, if left limit or right limit enter LL or RL.

(10) REMARKS: Enter any information that is considered useful in helping understand the range card. Enter the GRP data here if there is not sufficient room in the data section. (Record the data.)



DATA SECTION

POSITION IDENTIFICATION PRIMARY

DATE

WEAPON JAVELIN

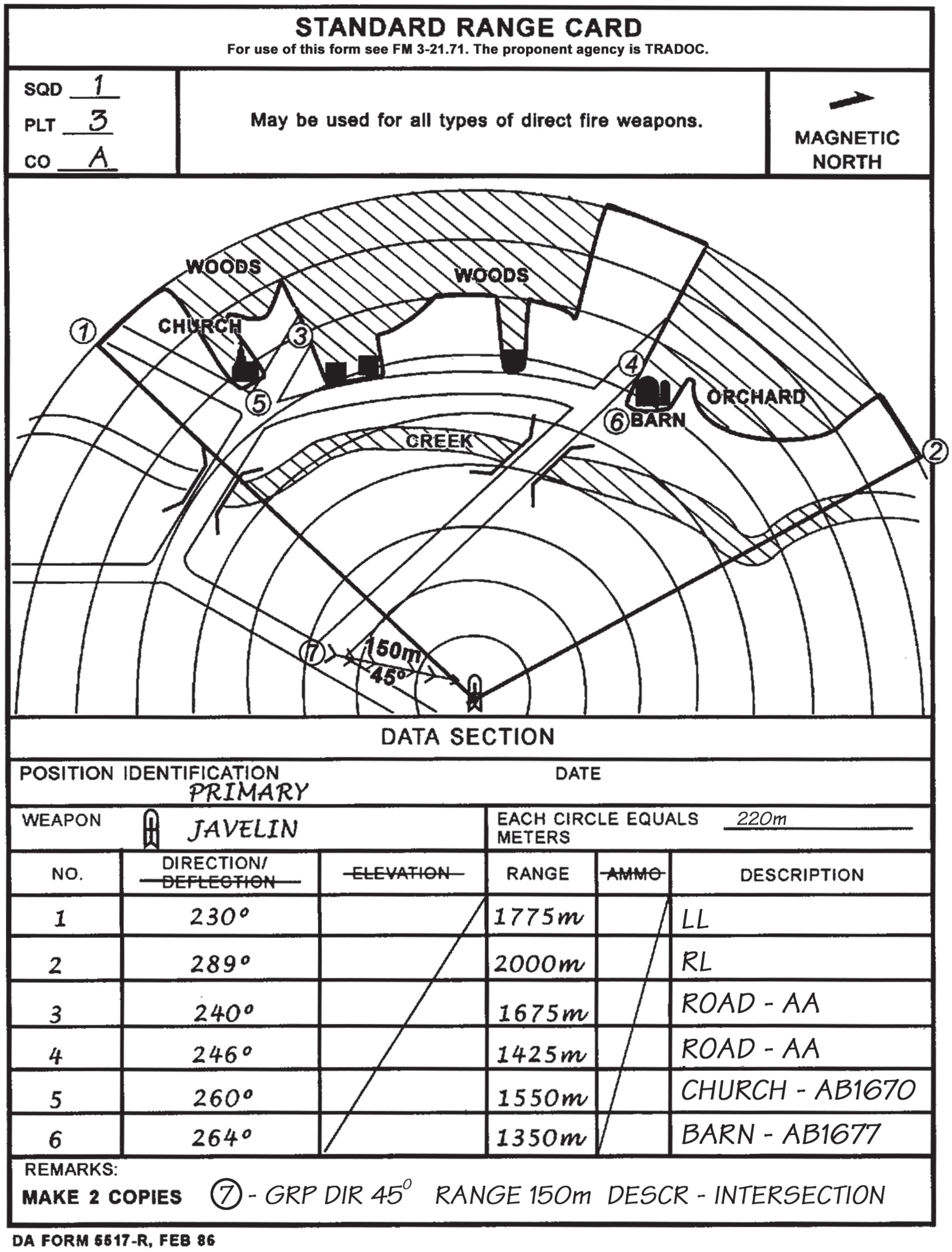
EACH CIRCLE EQUALS 220m METERS

NO.	DIRECTION/ ~~DEFLECTION~~	~~ELEVATION~~	RANGE	~~AMMO~~	DESCRIPTION
1	230°		1775m		LL
2	289°		2000m		RL
3	240°		1675m		ROAD - AA
4	246°		1425m		ROAD - AA
5	260°		1550m		CHURCH - AB1670
6	264°		1350m		BARN - AB1677

REMARKS:
MAKE 2 COPIES ⑦ - GRP DIR 45^0 RANGE 150m DESCR - INTERSECTION

DA FORM 5517-R, FEB 86

Figure B-11. DA Form 5517-R —data section



STANDARD RANGE CARD

For use of this form see FM 3-21.71. The proponent agency is TRADOC.

SQD 1
PLT 3
CO A

May be used for all types of direct fire weapons.

MAGNETIC NORTH

WOODS
WOODS
CHURCH
ORCHARD
BARN
CREEK
①
②
③
④
⑤
⑥
⑦
150m
45°

DATA SECTION

POSITION IDENTIFICATION PRIMARY
DATE

WEAPON JAVELIN
EACH CIRCLE EQUALS 220m METERS

NO.	DIRECTION/ ~~DEFLECTION~~	~~ELEVATION~~	RANGE	~~AMMO~~	DESCRIPTION
1	230°		1775m		LL
2	289°		2000m		RL
3	240°		1675m		ROAD - AA
4	246°		1425m		ROAD - AA
5	260°		1550m		CHURCH - AB1670
6	264°		1350m		BARN - AB1677

REMARKS:
MAKE 2 COPIES ⑦ - GRP DIR 45° RANGE 150m DESCR - INTERSECTION

DA FORM 5517-R, FEB 86

Figure B-12. Example completed DA Form 5517-R.

FIELD-EXPEDIENT RANGE CARD

B-17. A field-expedient range card is used when DA Form 5517-R is not available. Preparation of a field-expedient range card follows basically the same guidelines as a standard range card. The gunner can use just about anything to draw on as long as the data is recorded. As one example, a discarded MRE box works well (Figures B-13 and B-14).

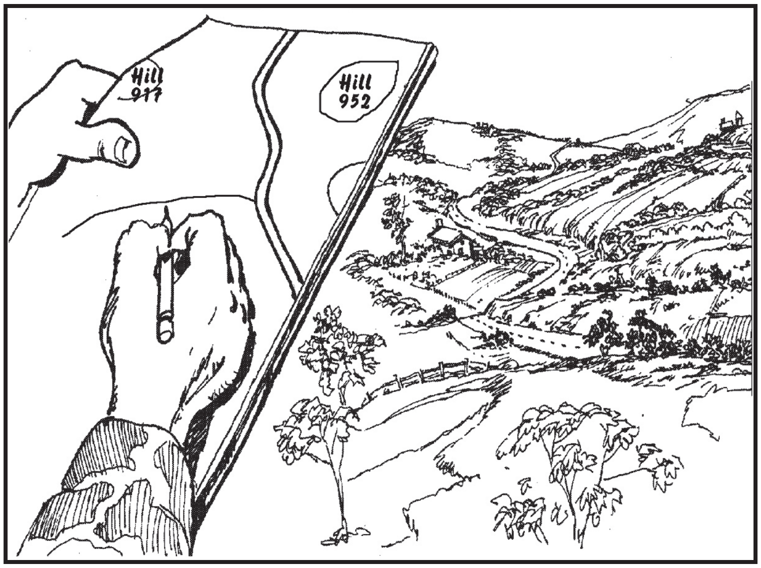

Hill
917
Hill
952

Figure B-13. Terrain presentation.

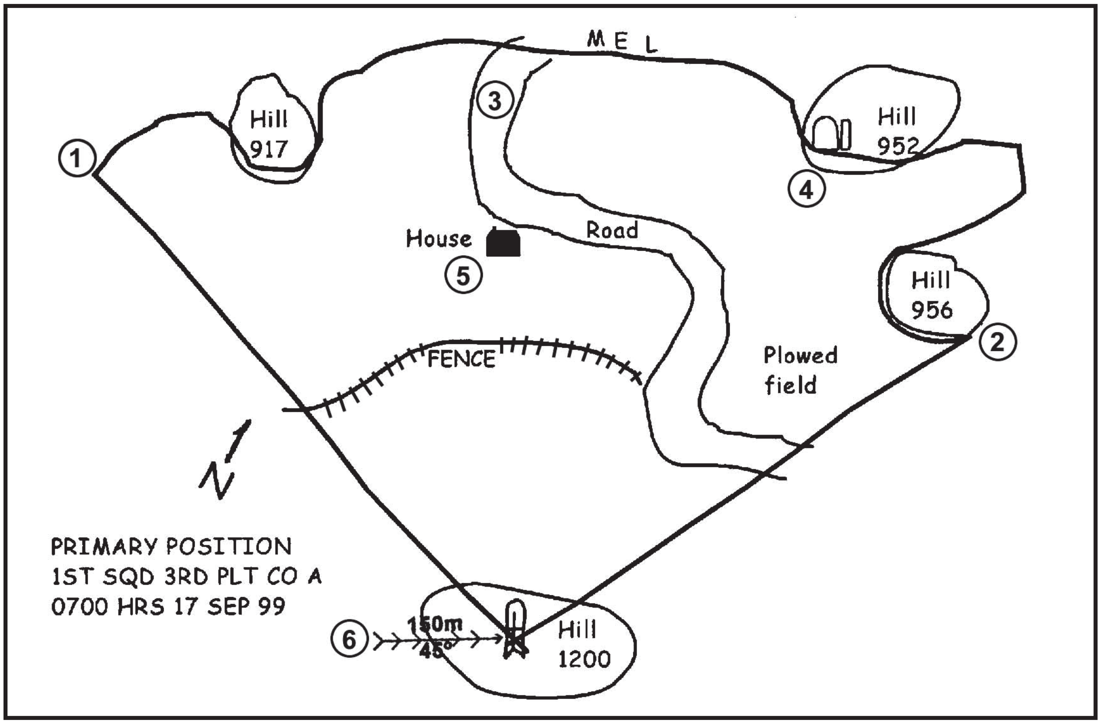

MEL
Hill
917
Hill
952
Hill
956
Hill
1200
House
Road
FENCE
Plowed
field
N
①
②
③
④
⑤
⑥
150m
45°
PRIMARY POSITION
1ST SQD 3RD PLT CO A
0700 HRS 17 SEP 99

Figure B-14. Field-expedient range card showing the terrain.

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Appendix C

IMMEDIATE DECONTAMINATION AND DESTRUCTION PROCEDURES

In combat, Soldiers may encounter chemical or biological agents. If this should occur, Soldiers must understand how to recognize chemical or biological agents and perform decontamination procedures. To accomplish this, decontamination procedures should follow the steps and procedures outlined in FM 3-11.4 and FM 3-11.5 and be IAW the unit SOP. In combat situations, the Javelin team could be ordered to destroy the Javelin system to prevent its capture or use by the enemy.

DECONTAMINATION PRINCIPLES

C-1. Decontamination is the removal or reduction in the hazardous level of chemical, biological, radiological, nuclear (CBRN) contamination from personnel, weapons, and materiel. Once a Soldier is aware of chemical or biological contamination, he initiates immediate decontamination techniques by using his personal skin decontamination kit (SDK) or individual equipment decontamination kit (IEDK). To remove radiological contamination from equipment and personnel, Soldiers brush it off or use soap and water. The following steps for immediate decontamination of the round and the CLU (Table C-1) reduce the spread or transfer of liquid contamination.

NOTES:

1. FM 3-11.5 and TM 3-4230-216-10 provide more information about decontamination procedures for equipment and weapons.
2. The Soldier can use his M291 IEDK or M295 IEDK to remove H-series, G-series, and V-series agents.

Table C-1. Javelin immediate decontamination procedures.

ROUND	CLU
Step 1 Decontaminate your gloves using the IEDK. Step 2 Decontaminate the round by patting it with the IEDK, working from the front to the rear until the entire round is covered. NOTE: When the shoulder strap is grossly contaminated, discard it. Step 3 Repeat Step 1.	Step 1 Decontaminate your gloves using the IEDK. Step 2 Decontaminate the CLU by patting it with the IEDK. Pay special attention to the handgrips, CLU carry handle, battery cover, round interface connector protective cover, switch boots, and absorbers. Step 3 Use a knife to cut the protective cover lanyard from the protective cover, and remove it.
Step 4 Discard the IEDK.	Step 4 Repeat Step 1. Step 5 Discard the IEDK.

WARNING

Do not apply IEDK to any optic lens. The charcoal inside the IEDK is abrasive; it will damage the lens.

DESTRUCTION GUIDANCE

C-2. Unless otherwise directed, the destruction of the Javelin occurs only when the commander gives the order. If the Javelin cannot be evacuated, the unit launches all remaining rounds and destroys the CLU.

NOTE: Destroy the same component in all weapon systems to prevent the enemy from assembling a complete system.

COMMAND LAUNCH UNIT AND ROUND

C-3. Each unit having, maintaining, or storing Javelin systems must have an SOP for destroying them. The destruction plan should be flexible enough to cover any situation, should state priorities and methods of destruction, and should provide clear instructions on how to conduct each method of destruction. The Javelin can be destroyed in several ways:

- The most efficient way of destroying the CLU is by destroying its optics. Smash the CLU's optics with an axe, pick, or crowbar; run over it with a tracked vehicle; or as a last resort, destroy it using small-arms fire.
- The best way of destroying the round is by launching it toward the enemy.

NOTE: If explosives are used, only Soldiers trained in their proper use should attempt to destroy the CLU and the round.

WARNING

Do not use mechanical methods to destroy live missiles.

COMMAND LAUNCH UNIT BATTERY AND BATTERY COOLANT UNIT

C-4. Before the destruction of the CLU, remove the battery.

WARNINGS

1. **The BA-5590/U battery contains pressurized sulfur dioxide gas. This gas is highly toxic, irritating, and flammable. In a well-ventilated area, destroy the battery using mechanical tools. A small puncture will disable the battery.**
2. **Wear eye protection when destroying the CLU and CLU batteries.**

Appendix D

WARNING INDICATORS AND MALFUNCTIONS

Understanding the proper procedures to correct malfunctions is an essential gunner skill. There are nine different indicators on the CLU display requiring the gunner to perform some type of action. Five indications occur or can occur during normal Javelin operation. The remaining four indicate some sort of Javelin malfunction for which there are immediate action procedures for the gunner to follow.

SECTION I. WARNING INDICATORS

D-1. Javelin warning indicators may illuminate during normal operations to alert the gunner of a system failure or impending failure if corrective actions are not taken immediately. The five warning indicators are NVS NOT COOL, NVS FOCUS ADJUSTMENT LIMIT, CLU BATTERY LOW, BCU LOW, and MISSILE NOT READY.

NIGHT VISION SIGHT NOT COOL

D-2. The following describes what the NVS NOT COOL indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-3. This light is an amber warning indicator (Figure D-1).

POSSIBLE REASONS

D-4. When the CLU power switch is placed in the NIGHT position during the initial power up of the Javelin, the NVS NOT COOL indicator comes on. It alerts the gunner that the DDC has not cooled down the NVS to its normal operating temperature. The time for the DDC to cool is normally 2.5 minutes. When the DDC has cooled down, the NVS NOT COOL indicator automatically turns off. If the NVS NOT COOL indicator comes back on after the NVS cooldown, the gunner places the power switch in the DAY position and uses the day FOV to complete the mission.

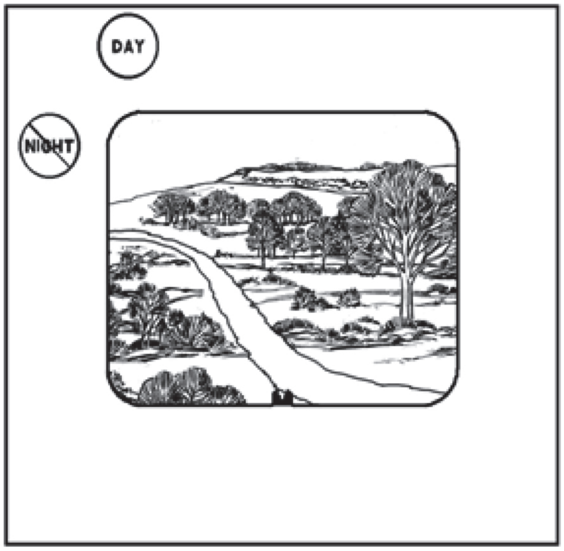

Figure D-1 Amber NVS NOT COOL indicator–on.

GUNNER'S CORRECTIVE ACTION

D-5. See Table D-1.

Table D-1. Gunner corrective actions for NVS NOT COOL indicator.

INDICATOR—AMBER	MEANING	EFFECT	CORRECTIVE ACTION
On	NVS Not Cool	WFOV and NFOV are not available for 2.5 minutes after setting power switch to NIGHT.	Use day FOV until NVS reaches cooldown.
On	Does not go out after 2.5 minutes.	DDC not operating WFOV and NFOV not available.	Replace the CLU or use day FOV for target engagement.
Off	Goes out after NVS reaches cooldown in 2.5 minutes.	After cooldown, WFOV and NFOV are available for use.	Use WFOV and/or NFOV as desired.
On	DDC not cooling NVS.	NVS target image may be degraded.	Place power switch in the DAY position. If problem persists, replace the CLU.

NIGHT VISION SIGHT FOCUS ADJUSTMENT LIMIT

D-6. The following describes what the NVS focus adjustment limit indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-7. This light is green and is a warning indicator (Figure D-2).

POSSIBLE REASONS

D-8. The WFOV or NFOV flashes when the NVS reaches a focus limit (near or far).

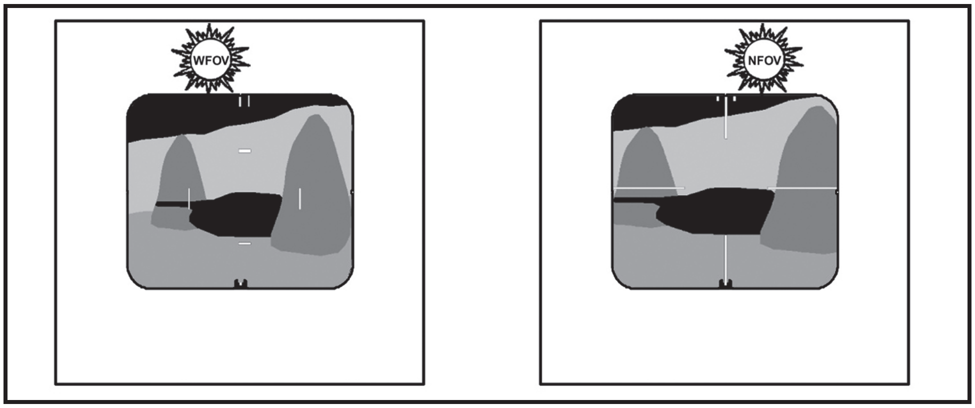

Figure D-2. WFOV or NFOV indicator—flashing.

GUNNER'S CORRECTIVE ACTION

D-9. The respective WFOV/NFOV indicator flashes when the gunner moves the FOCUS switch in the direction of the focus limit. The gunner stops moving the switch and reverses the direction (Table D-2).

Table D-2. Gunner corrective action for flashing WFOV and NFOV indicators.

INDICATOR—GREEN	MEANING	EFFECT	CORRECTIVE ACTION
WFOV (Flashing)	NVS Focus Limit (WFOV)	Adjust focus in the other direction.	Move the FOCUS switch in the opposite direction.
NFOV (Flashing)	NVS Focus Limit NFOV)	Adjust focus in the other direction.	Move the FOCUS switch in the opposite direction.

COMMAND LAUNCH UNIT BATTERY LOW

D-10. The following describes what the CLU BATTERY LOW indicator looks like and the reason the light comes on. The gunner takes corrective action this light comes on.

INDICATOR

D-11. This light is red and is a warning indicator (Figure D-3).

POSSIBLE REASONS

D-12. The CLU BATTERY LOW indicator comes on when the gunner has operated the Javelin about 4 hours. The CLU BATTERY LOW indicator alerts the gunner that he has about 5 minutes of operating time remaining. If the gunner continues to operate the Javelin, the CLU display automatically reverts to the day FOV.

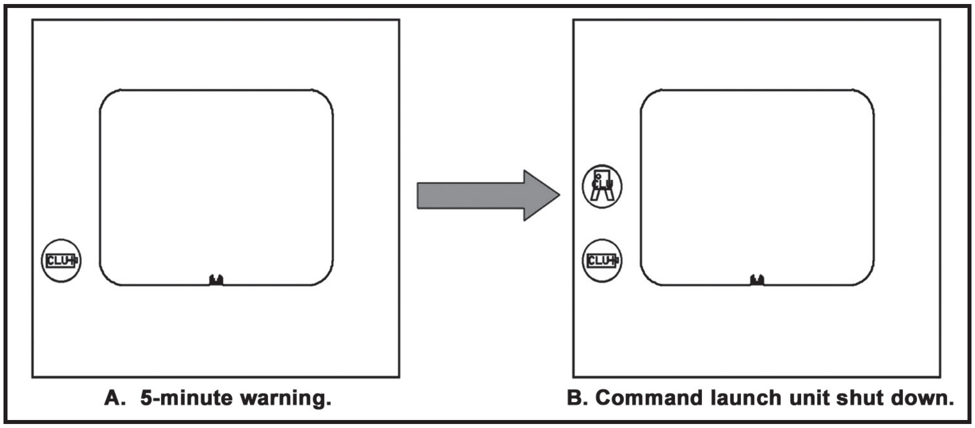

Figure D-3. CLU BATTERY indicator—on.

GUNNER'S CORRECTIVE ACTION

D-13. The gunner immediately removes the spent battery when the CLU BIT FAILURE indicator comes on (Table D-3).

Table D-3. Gunner corrective action for CLU BATTERY LOW indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
On	CLU Battery Low About 5 minutes until CLU power shutdown.	Seeker can be activated and missile can be launched.	Complete engagement (if in progress). If engagement is not in progress, turn CLU off, replace CLU battery, resume mission.
On	CLU power shutdown.	CLU automatically switches to day FOV. The CLU BIT FAILURE indicator comes on. If the spent CLU battery is not removed immediately, other indicators around the CLU display will start flashing and a clicking sound can be heard by the gunner. The missile cannot be launched.	Replace CLU battery.

BATTERY COOLANT UNIT LOW

D-14. The following describes what the BCU LOW indicator looks like (Figure D-4) and the reason the light comes on (Table D-4). The gunner takes corrective action when this light comes on.

INDICATOR

D-15. This light is red and is a warning indicator.

POSSIBLE REASONS

D-16. The gunner has a target in sight and is preparing to launch the missile. The gunner activates the seeker and attempts to engage the target. The BCU has about 4 minutes of life once the gunner activates it. The BCU indicator flashes when the BCU has about 30 seconds of operating time remaining. At this point, the gunner can still launch the missile. When the BCU battery is spent, the BCU indicator stops flashing and remains ON. The missile powers down, and the CLU display automatically reverts back to the previous FOV.

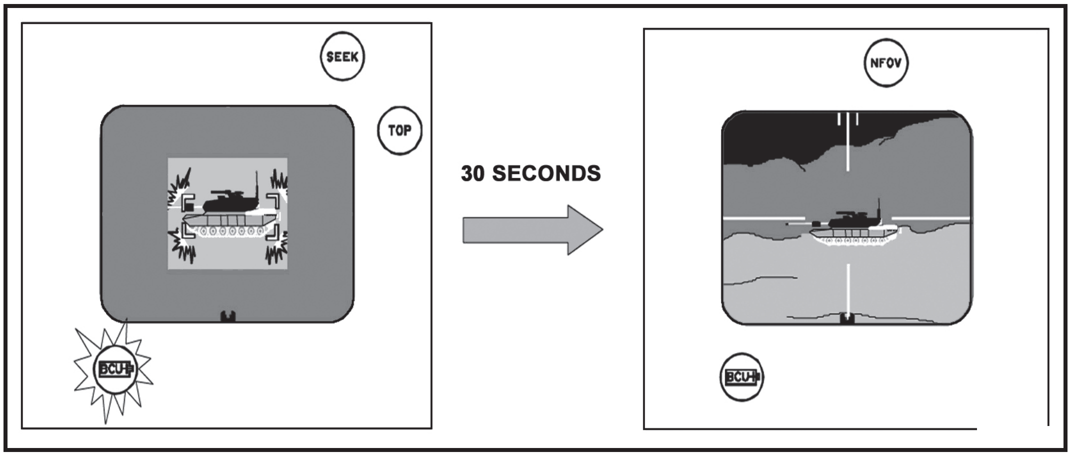

Figure D-4. BCU LOW indicator—flashing/on.

GUNNER'S CORRECTIVE ACTION

D-17. See Table D-4.

Table D-4. Gunner corrective action for BCU LOW indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
Flashing	BCU Low: BCU has about 30 seconds of operating time remaining.	Missile launch still possible before indicator stops flashing.	
On (Solid)	BCU is expended.	Missile has no power and cannot be launched. CLU display reverts to previous FOV.	Replace the BCU. Resume the mission.

MISSILE NOT READY

D-18. The following describes what the MISSILE NOT READY indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-19. This light is a multipurpose warning indicator. It can indicate a normal operation or a malfunction condition.

POSSIBLE REASONS

Normal Operation

D-20. When the gunner squeezes the seeker trigger and the MISSILE NOT READY indicator lights stays on for 10 to 15 seconds, the software download to the missile is not complete, missile BIT is not complete, seeker is not cooled down, or seeker video is not ready. After the seeker is cool and the software download is complete, the MISSILE NOT READY indicator goes off, and the seeker FOV is displayed on the CLU display (Figure D-5).

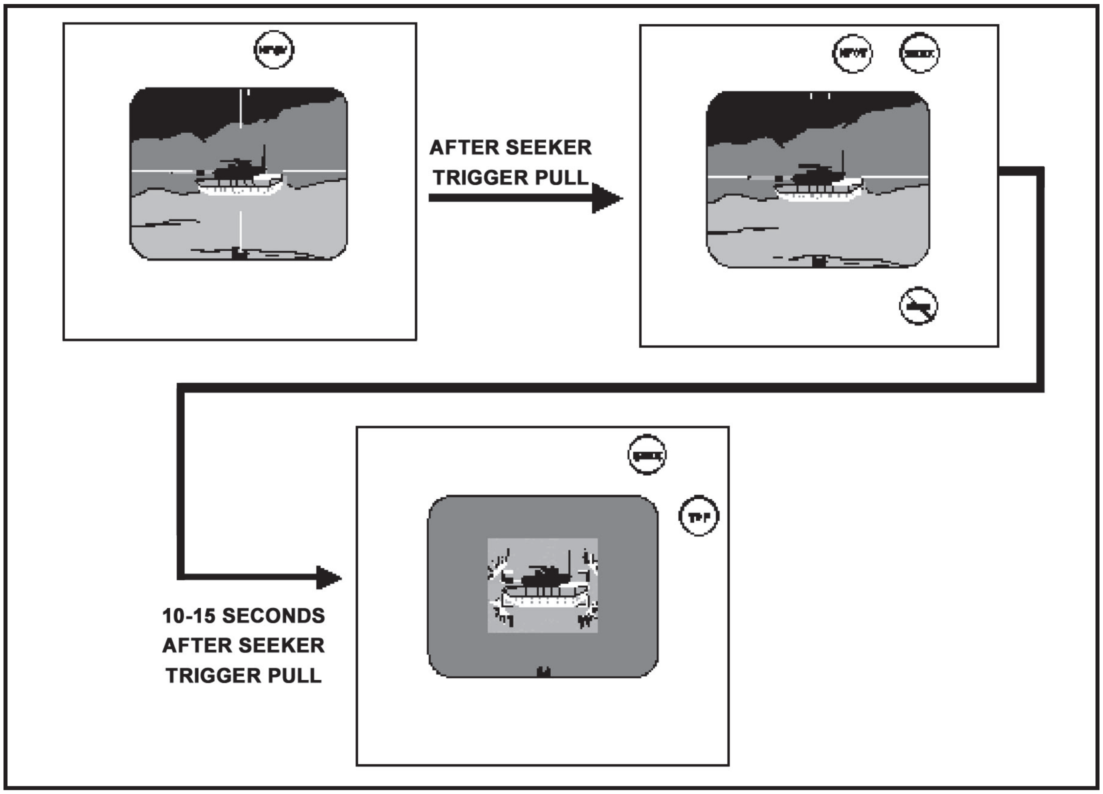
AFTER SEEKER TRIGGER PULL
10-15 SECONDS AFTER SEEKER TRIGGER PULL

Figure D-5. NFOV to seeker FOV sequence.

Malfunctions

D-21. If the gunner has activated the seeker and not launched the missile, it is possible that the missile will overheat when the BCU is replaced (Figure D-6).

- After seeker cooldown and seeker FOV is available, attempt to re-engage the target. If the BCU and the MISSILE NOT READY indicators start to flash, the missile is approaching an overheat condition.
- When the MISSILE NOT READY indicator goes off, the missile cannot be launched. The missile powers down, the CLU reverts to the previous FOV, and the MISSILE BIT FAILURE indicator comes on as a solid light.

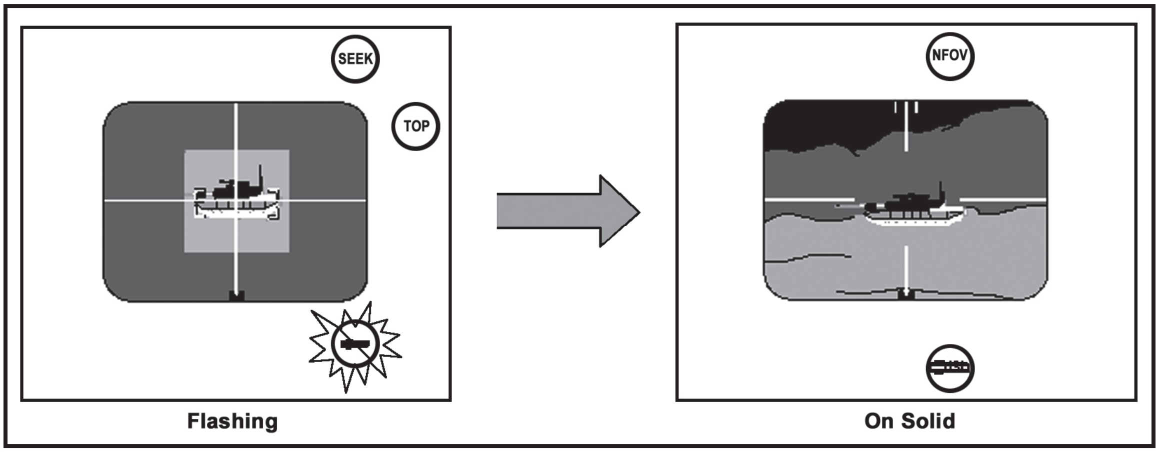
SEEK
TOP
NFOV
Flashing
On Solid

Figure D-6. MISSILE NOT READY indicator.

GUNNER’S CORRECTIVE ACTION

D-22. See Table D-5.

Table D-5. Gunner corrective action for MISSILE NOT READY indicator.

INDICATOR— AMBER/RED	MEANING	EFFECT	CORRECTIVE ACTIVE
Amber	Missile Not Ready		
On	After pulling the seeker trigger. Software download begins.	Missile cannot be launched until indicator goes off.	Wait for indicator to go off before attempting any track gate adjustment.
Stays on	One or all of the following may have occurred: 1. Software download not completed. 2. Missile BIT not completed. 3. Seeker not cool. 4. Seeker video not ready.	Missile cannot be launched until indicator goes off.	Wait for indicator to go off before attempting any track gate adjustment. If indicator remains on longer than 15 seconds, replace the round.
Off	1. Software download completed. 2. Missile BIT completed. 3. Seeker video available.	Missile launch available.	Track gate adjustment possible.
Flashing	After the seeker is activated, the missile begins to overheat.	Missile launch is still possible.	
Off		MISSILE NOT READY indicator goes off, the missile cannot be launched. Missile powers down, the CLU reverts to previous FOV, and the MISSILE BIT FAILURE indicator comes on solid.	
Red (Solid)	Missile has overheated.	Missile cannot be launched. Missile powers down, the CLU reverts to previous FOV, and the MISSILE BIT FAILURE indicator comes on solid.	Turn off CLU. Replace the round.

SECTION II. MALFUNCTION INDICATORS

D-23. There are four malfunction indicators for which the gunner takes immediate action. These malfunction indicators are CLU BIT FAILURE, MISSILE BIT FAILURE, MISFIRE, and HANGFIRE.

COMMAND LAUNCH UNIT BUILT-IN TEST FAILURE

D-24. The following describes what the CLU BIT FAILURE indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-25. This light is red and is a malfunction indicator.

POSSIBLE REASONS

D-26. The CLU BIT FAILURE indicators light up if any or all of the following conditions exist:

- CLU fails continuous BIT.
- CLU does not initiate software download to the missile.
- CLU battery is spent and CLU reverts to day FOV (Figure D-7).

NOTE: If the CLU BIT FAILURE indicator comes on after seeker activation, attempt to launch the missile (if appropriate) and report it.

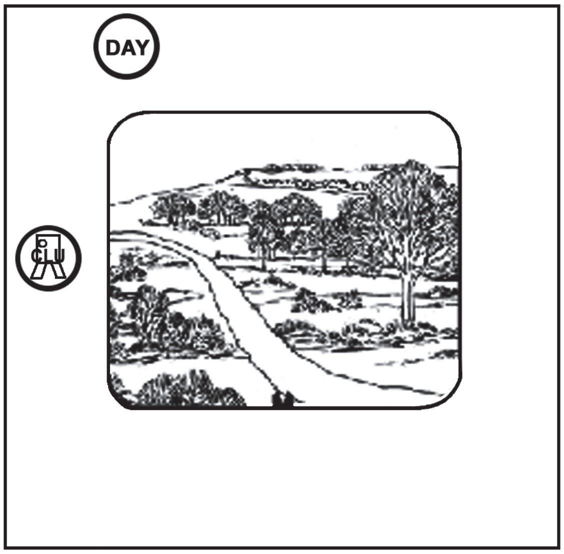

Figure D-7. CLU BIT FAILURE indicator.

GUNNER'S CORRECTIVE ACTION

D-27. If the gunner is engaging a target and has activated the seeker, complete the target engagement, if possible (Table D-6). If the gunner is not engaging a target or cannot complete the engagement, he performs the following:

(1) Turns the power switch to the OFF position.
(2) Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.
(3) Keeps the Javelin pointed in the direction of the enemy target. Ensures the backblast area remains clear at all times.
(4) Presses the latch release and disconnects the CLU from the round for use with a new CLU.
(5) Obtains a new CLU and connects the new CLU to the round.
(6) During training situations, turns power switch to OFF, disconnects the CLU from the round, and notifies the squad leader or range safety personnel.

Table D-6. Gunner corrective action for CLU BIT FAILURE indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
On	CLU BIT Failure 1. CLU failed continuous BIT.	Missile launch not possible.	Replace the CLU.
	2. CLU did not initiate software download to missile.	Missile launch not possible.	Replace the CLU.
	3. CLU did not complete software download to missile.	Missile launch not possible.	Replace the CLU battery.
	4. CLU battery spent.	CLU powers down and switches to day FOV.	Replace the CLU battery.

MISSILE BUILT-IN TEST FAILURE

D-28. The following describes what the MISSILE BIT FAILURE indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-29. This light is red and is a malfunction indicator.

POSSIBLE REASONS

D-30. The missile BIT software has detected a failure in the missile (Figure D-8). When the missile fails BIT, the MISSILE BIT FAILURE indicator lights up, the missile powers down, and the CLU display reverts to the previous FOV. The missile must be replaced.

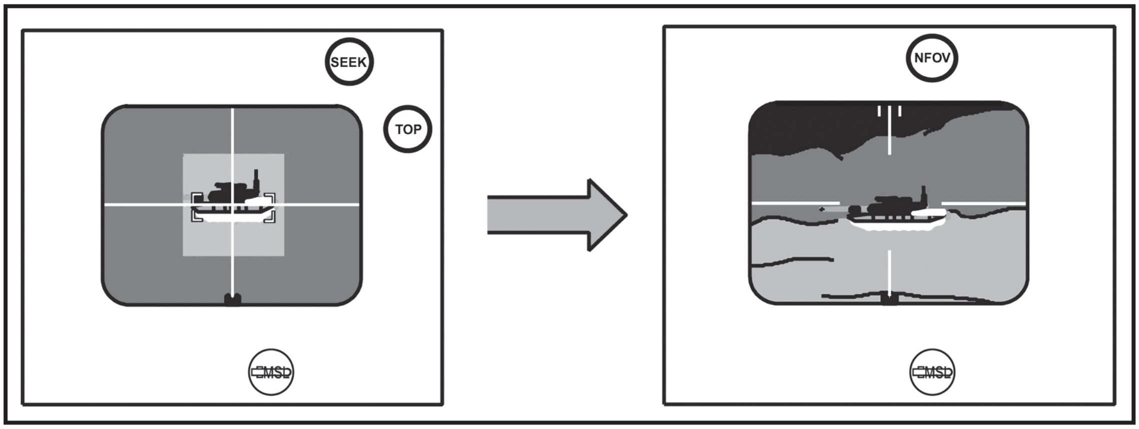

Figure D-8. MISSILE BIT FAILURE indicator—solid on.

GUNNER'S CORRECTIVE ACTION

D-31. See Table D-7.

Table D-7. Gunner corrective action for MISSILE BIT FAILURE indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
Red	Missile BIT Failure		
On (Solid)	Missile BIT has detected a fault within the missile or CLU is not communicating with the missile.	Missile launch not possible, CLU display reverts to previous FOV.	Replace round.

MISFIRE

D-32. The following describes what the BIT FAILURE indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-33. This light is a red and is a malfunction indicator. The MISSILE BIT FAILURE indicator may or may not be flashing.

POSSIBLE REASONS

D-34. A misfire occurs when the gunner locks onto a target, squeezes the trigger and the missile does not launch. One of two things will happen with the status indicator: no malfunction indicators or a red

MSL flashes (Figure D-9). In either case the seeker FOV remains on the CLU display and the green SEEK and TOP indicators remain lit.

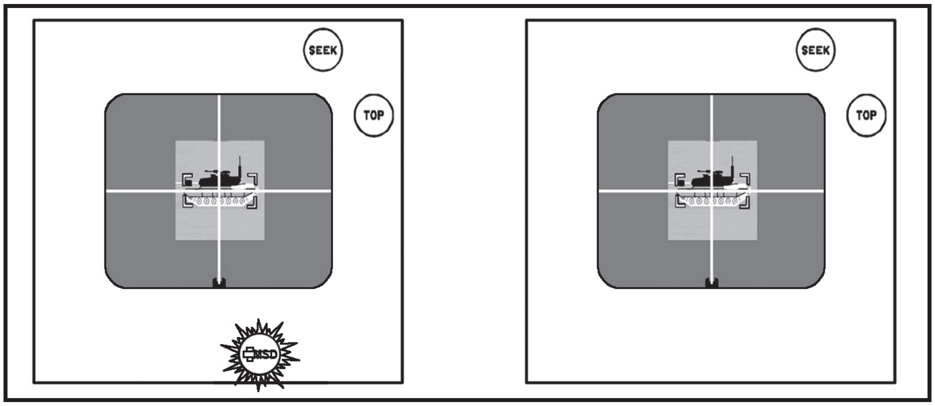

Figure D-9. Misfire—with and without warning indicators.

GUNNER'S CORRECTIVE ACTION

D-35. When a misfire happens after the trigger squeeze occurs with or without warning indicators, the missile does not launch (See Table D-8.). The gunner performs immediate action procedures for a misfire:

(1) Attempts to engage the target again.
  - Releases the seeker and fire triggers.
  - Acquires the target again, if necessary.
  - Attempts to lock-on again.
  - Attempts to fire the Javelin again.

(2) If the Javelin misfires again, the gunner:
  - Turns off the CLU.
  - Places the Javelin on the ground with the CLU handgrips pointing up.
  - Keeps the Javelin pointed in the direction of the enemy target while keeping the backblast area clear.

(3) Checks the interface connectors:
  - Presses the latch release, disconnects the CLU from the round, and checks for dirt and debris.
  - Reconnects the CLU to the same round.
  - Turns ON the CLU.

(4) Attempts to engage the target again. Repeats the procedures for Step 1. If the Javelin still fails to fire:
  - Turns off the CLU.
  - Grounds the Javelin, again keeping the missile pointed toward the enemy.
  - Disconnects the CLU from the round.
  - Moves at least 25 meters away from the round or moves the round 25 meters away from the firing position.
  - Stays clear of the forward and aft ends of the round at all times.
  - Obtains a replacement round and connects CLU to the new round.
  - Continues the mission.

(5) If the misfire continues on the new round, the gunner obtains a new CLU. Always remember to replace the BCU on the round.

Table D-8. Gunner corrective action for MISSILE MISFIRE indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
Flashing or None			
Red (On)	Misfire	Missile may not launch.	Refer to paragraph D-33.

ACTIONS DURING TRAINING EXERCISES

D-36. The gunner—

(1) Announces "Misfire" loud enough for all Soldiers in the immediate area to hear.

(2) Attempts to engage the target again.
- Releases the seeker and fire triggers.
- Acquires the target again, if necessary.
- Attempts lock-on again.
- Attempts to fire the Javelin again.

(3) If the Javelin continues to misfire:
- Turns off the CLU.
- Places the Javelin on the ground with the CLU handgrips pointing up.
- Keeps the Javelin pointed in the direction of the enemy target while keeping the backblast area clear.

(4) Checks the interface connectors:
- Presses the latch release and disconnects the CLU from the round.
- Checks the CLU and round interface connector for foreign objects.
- Connects the CLU again to the same round.
- Turns on the CLU.

(5) Attempts to engage the target again. Repeats the procedures for Step 1. If the Javelin still fails to fire:
- Turns off the CLU.
- Grounds the Javelin, again keeping it facing toward the target.
- Disconnects the CLU from the round.
- Moves the round 25 meters away from the firing position.

(6) Notifies the range safety officer/NCO of the type of malfunction.

HANGFIRE

D-37. The following describes what the HANGFIRE indicator looks like and the reason the light comes on. The gunner takes corrective action when this light comes on.

INDICATOR

D-38. This light is red and is a malfunction indicator.

POSSIBLE REASONS

D-39. A hangfire occurs when the gunner squeezes the fire trigger but the missile does not launch and the HANGFIRE indicator flashes on the CLU display (Figures D-10). If a hangfire occurs during a combat situation, release the fire and seeker triggers. Continue pointing the missile in the direction of the enemy target for at least 60 seconds. After waiting 60 seconds, perform the procedures outlined in Table D-9.

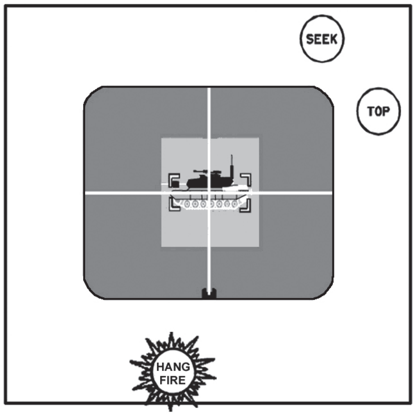

Figure D-10. HANGFIRE indicator.

GUNNER'S CORRECTIVE ACTION

D-40. The gunner—

(1) Turns off the CLU.

(2) Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.

(3) Keeps the Javelin pointed in the direction of the enemy target. Ensures the backblast area remains clear.

(4) Removes the CLU. Presses the latch release and disconnects the CLU from the round.

(5) Moves at least 25 meters away from the round. If in a firing position, moves the round to a position at least 25 meters from the firing position. Stays clear of the forward and aft end of the round at all times.

(6) Obtains a replacement round and connects the CLU to the new round.

Table D-9. Gunner corrective action for HANGFIRE indicator.

INDICATOR—RED	MEANING	EFFECT	CORRECTIVE ACTION
Flashing	HANGFIRE Missile does not fire.	Activated missile in LTA, could still possibly launch.	Refer to paragraph D-38.

ACTIONS DURING TRAINING EXERCISES

D-41. The missile did not fire. The gunner—

(1) Announces "Hangfire" loud enough for everyone to hear.

(2) Keeps the missile pointed down-range. Releases the seeker and fire triggers.

(3) Waits 5 minutes before completing HANGFIRE procedures:

- Turns off the CLU.
- Removes the Javelin from the shoulder and places it on the ground with the CLU handgrips pointing up.

(4) Disconnects the CLU from the round.

(5) Moves at least 25 meters away from the round. If in a firing position, moves the round to a position at least 25 meters from the firing position. Stays clear of the forward end and aft end of the round at all times.

(6) Obtains a replacement round and connects the CLU to the new round.

GENERAL PRACTICAL EXERCISES FOR WARNINGS AND MALFUNCTIONS

D-42. The BST is designed to reproduce all the warning conditions and malfunctions. Trainers should include in their training exercises with as many warnings and malfunctions as time will allow. It is essential that the gunner understand exactly what is going on at all times. Battlefield conditions do not allow for hesitation; therefore, the gunner's reaction must be automatic.

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Appendix E

FORWARD LOOKING INFRARED

This appendix provides the gunner with a greater understanding of how the Javelin acquires its target. Visible light is seen either directly from a light source or indirectly as the light reflects from an object into the eye. The Javelin is able to create images using the infrared (IR) part of the spectrum in a process referred to as imaging infrared system (I2R).

INTRODUCTION

E-1. The Javelin allows the gunner to see a target at night and during light rain, fog, haze, or dusty atmospheric conditions by taking advantage of a type of energy similar to visible light, known as "infrared."

ELECTROMAGNETIC SPECTRUM

E-2. The electromagnetic spectrum (Figure E-1) contains various forms of energy including radio and television transmission spectrums, x-rays, and visible light humans can see. Visible light is a very small portion of the overall electromagnetic spectrum. Each type of energy is assigned a place in the spectrum according to its frequency—from lowest to highest. As the frequency changes, the characteristics change, so types of energy are bundled into groups of frequencies, or bands, which have similar characteristics. The Javelin uses the IR band for its sights (NVS and seeker).

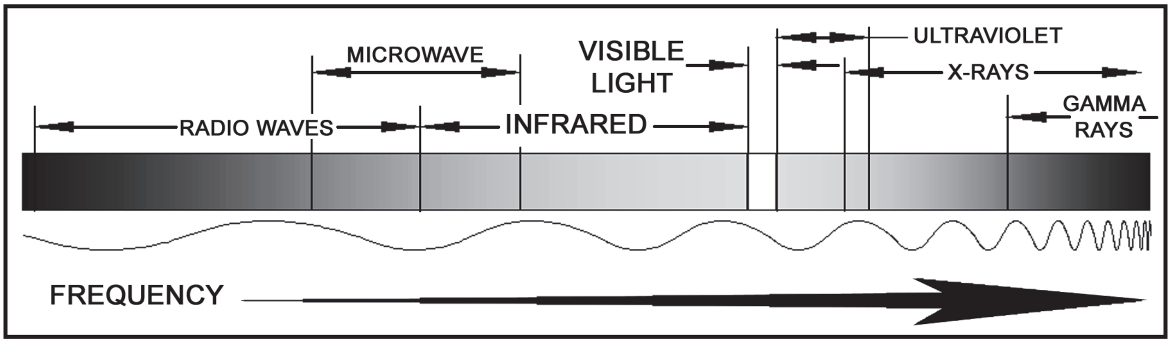


Figure E-1. Electromagnetic spectrum.

E-3. The Javelin operates, using frequencies in only a small part of the IR band (Figure E-2). Other weapon systems operate in this same area, such as the TOW and Dragon, which means the gunner should be able to see anything with the TOW and the Dragon that he can see with the Javelin.

E-4. Other systems operate using frequencies in other parts of the IR band. This operation includes such equipment as the commander's ground pointer (CGP) and night vision goggles (NVGs). Using the CGP and NVGs as an example, when the platoon leader points to a target with the CGP, the gunner can see what the platoon leader points at because the NVGs that the gunner wears operates at the same IR frequency as the CGP. Using the Javelin, the gunner cannot see where the CGP points because it emits a beam outside the IR band that the Javelin uses.

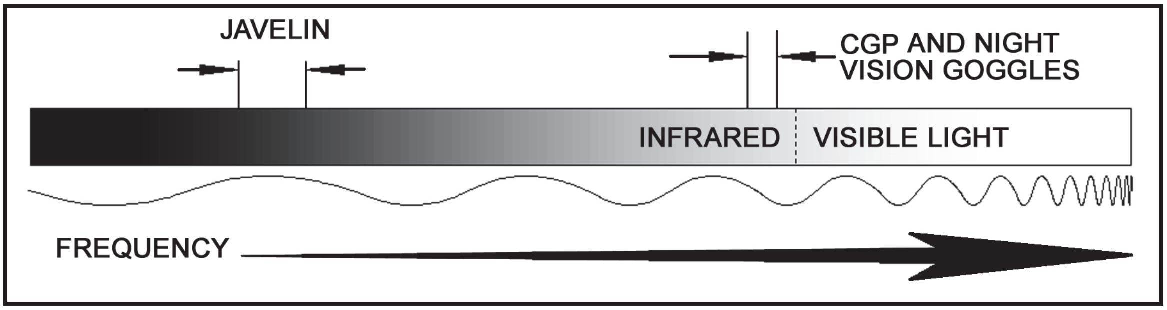


Figure E-2. Infrared band.

INFRARED WAVES

E-5. The IR waves are a radiant, an electromagnetic form of heat. Heat creates IR waves and IR waves create heat. For instance, the heat lamps at fast-food restaurants are above the food, yet they keep the food warm even though heat rises. The reason is that the lamps radiate IR waves down onto the food, and when the IR strikes the food, the food warms up. IR can be emitted in any direction.

INFRARED SOURCES

E-6. Everything on the face of the earth emits IR in the IR band used by the Javelin. Hotter objects emit more IR, and cooler objects emit less. Some objects are classified as IR sources meaning they are able to stay hot by themselves using another form of energy—such as nuclear energy, combustion, and friction—to generate heat energy.

Nuclear Energy

E-7. Nuclear energy is produced either by splitting atomic particles (called fission) or combining atomic particles together in different forms (called fusion). The sun uses a nuclear reaction to generate heat and is our primary source of IR energy.

Combustion

E-8. Combustion (Figure E-3) means there is heat produced by a slow (such as a bonfire) or very quick (such as a controlled explosion) burning. Vehicle engines generate heat due to combustion.

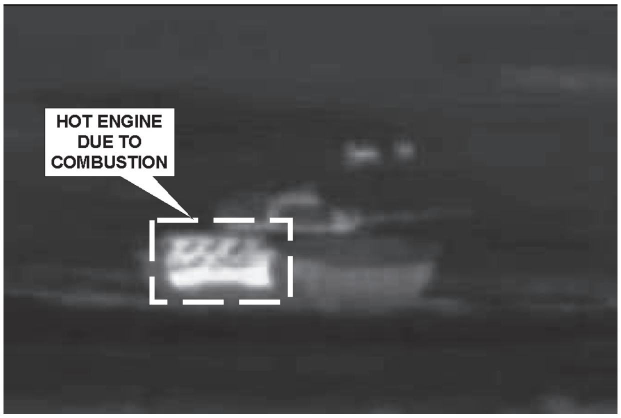


Figure E-3. Heat caused by combustion.

Friction

E-9. Friction produces heat by rubbing objects together. For example, when you rub your hands together very quickly, friction causes your hands to warm up, which causes them to give off more IR.

The same reaction occurs when a vehicle moves. Its suspension and motion mechanism (tires or tracks) creates friction moving against themselves or against the ground causing the suspension parts to warm up and produce IR (Figure E-4).

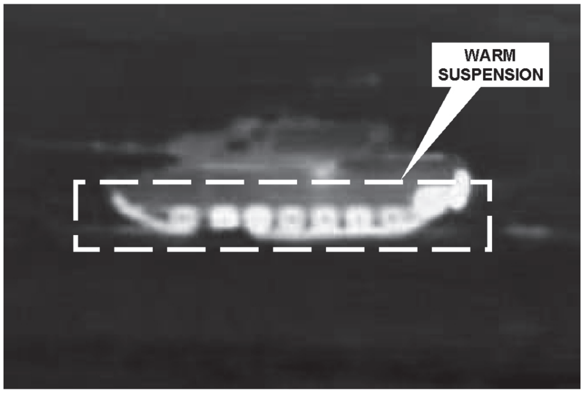


Figure E-4. Heat caused by friction.

INFRARED CHARACTERISTICS

E-10. All objects have the IR characteristics of reflection (if IR energy is reflected as in a mirror), absorption (if IR energy is absorbed as in friction), and emission (if IR energy comes from an IR source as in combustion). Like visible light, IR is affected by being transmitted through the atmosphere.

Reflecting Versus Absorbing

E-11. All objects reflect and absorb IR energy in varying amounts. What is not absorbed is reflected. Objects that reflect IR well do not absorb it well. Plant life, such as trees and grass, reflects IR well. This reflection makes the plants appear to heat up instantly when the sun strikes them and to cool off instantly when the sun blocks the plants.

E-12. Absorbing is the opposite of reflecting. Objects that absorb IR well do not reflect it well. Objects such as tanks and rocks absorb IR well. When the sun comes up, this absorption makes these objects stay cold or cool for a longer time when everything else is warm. When the sun goes down, these objects stay hot much longer than other objects in the target scene. For example, illumination tape that becomes dimmer the longer it glows.

Emitting Infrared

E-13. Emitting is closely associated with absorbing. Just like illumination tape that absorbs light before it glows, objects are heated to emit IR. For example, an emitting source is like a combustion engine that generates heat or the human body. When an object absorbs IR, it warms up. As it warms up, it emits more IR. When the heat source is removed, the object continues to emit IR, which causes it to cool off, and the amount of IR that it emits steadily decreases.

Transmitting Infrared

E-14. Just like light, IR is affected by particles in the atmosphere known as obscurants because they obscure the gunner's view of the target scene. Obscurants include such things as dust, snow, hail, sleet, fog, and so forth. The effect these obscurants have on IR is noticeably less than their effect on light. Unlike light, some obscurants have no effect on the ability to see an IR image.

E-15. Obscurants with large-sized particles—snow, sleet, rain, fog, and some forms of smoke—affect the amount of IR that reaches the NVS. As these obscurants become thicker or heavier, the amount of IR that reaches the NVS decreases, which decreases the range at which a gunner can see a target with the NVS.

PHYSICAL PROPERTIES

E-16. When the sun comes up, some natural or manmade objects may heat up faster than others do because they have different IR characteristics. An object's IR characteristics are determined by its physical properties—its mass, density, color, and texture. These properties combine to enhance an object's ability to reflect or absorb the IR that comes into contact with it.

Color

E-17. Light colored objects, such as a vehicle with desert camouflage, reflect more IR than they absorb, and heat slowly in the sun (Figure E-5). Dark colored objects, such as a vehicle with woodland camouflage, absorb more IR than they reflect, and heat quickly in the sun.

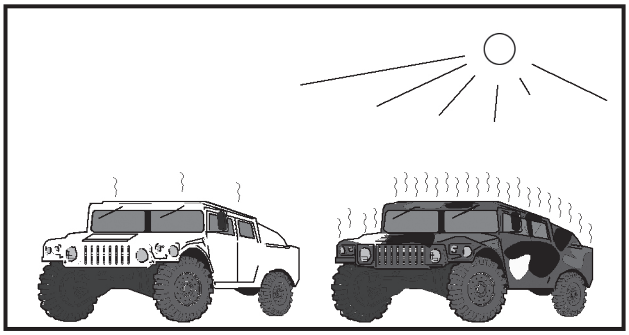


Figure E-5. Infrared affected by color.

Density

E-18. When objects such as trees and grass are exposed to sunlight, they do not become too hot to touch because they do not absorb IR well. As a result, they do not emit IR well, either. The reason is because the material they are made of is not very dense or heavy.

E-19. When objects such as vehicles and rocks are exposed to sunlight, they can become too hot to touch because they absorb and emit IR well. The reason is because these objects are denser or heavier than the trees and grass.

Surface Texture

E-20. Although a military high-mobility multipurpose wheeled vehicle (HMMWV) and the civilian version (Hummer) both become hot when exposed to sunlight, the Hummer does not heat up as fast as the HMMWV does. The reason for this is the difference in the surface texture, or finish, on the two vehicles. The Hummer has a smooth, waxed surface which tends to reflect well, whereas the HMMWV has a rough surface due to the chemical-agent resistant coating (CARC) paint that tends to absorb well (Figure E-6).

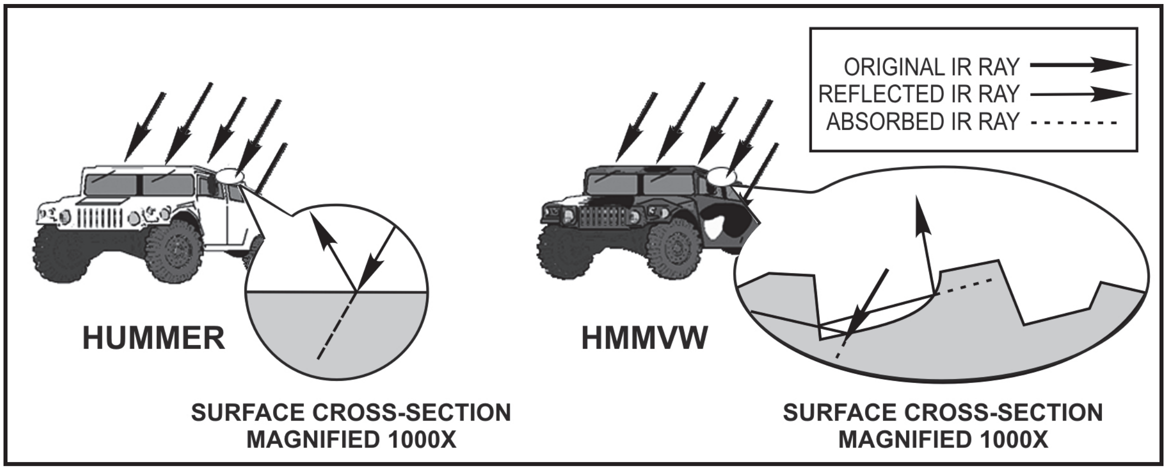

ORIGINAL IR RAY
REFLECTED IR RAY
ABSORBED IR RAY
HUMMER
HMMVW
SURFACE CROSS-SECTION MAGNIFIED 1000X
SURFACE CROSS-SECTION MAGNIFIED 1000X

Figure E-6. Smooth versus rough surface texture.

Mass

E-21. The more mass an object has, the more IR it can absorb, the longer it takes to heat up, the longer it can emit IR, and the longer it takes to cool off.

E-22. When both a tank and an M16 are in the sun, the armor plates on the tank take longer to heat up than the barrel of the M16 because they have more mass. As a result, the armor plates absorb more IR, and they take longer to heat up to the same temperature as the M16 barrel. Once they are hot, the armor plates emit IR for a much longer time than the barrel of the M16 and they take longer to cool off.

INFRARED SYSTEMS

E-23. There are two types of IR systems: non-imaging and imaging.

NON-IMAGING SYSTEMS

E-24. Non-imaging systems, such as the Stinger surface-to-air missile, are known as heat seekers. Heat seekers do not provide an IR image of the target.

IMAGING SYSTEMS

E-25. The imaging systems convert IR into a visible-light image. The Javelin is an imaging system providing an IR image that can be used to engage a target. When the missile is launched, it uses a similar image to guide it to the target.

ΔT

E-26. The NVS and seeker use IR to create images regardless of visible light levels. The images they display are made possible by the presence of ΔTs. ΔTs allow us to distinguish between one part of the target scene and another—whether it is different parts of the same object or different objects in the target scene. The gunner can use the Javelin's IR imagery during the day as well as at night.

DEFINITION

E-27. ΔT is an abbreviation for change in temperature or difference in temperature. Delta (Δ) is a Greek letter that stands for change or difference. T stands for temperature.

TEMPERATURE/INFRARED RELATIONSHIP

E-28. As the temperature of an object increases, so does the amount of IR it emits. For example, the engine compartment on a tank with its engine running emits more IR than the front of the hull.

DISPLAY OF INFRARED LEVELS

E-29. The NVS and seeker display IR levels as a change in brightness, according to each object's temperature. The coldest objects in a target scene appear black; the hottest appear bright green. Everything in between appears as increasingly brighter shades of green as each object's temperature increases. For example, the engine compartment on a tank with its engine running appears bright green (Figure E-7). Since the hull generally is the coldest part of a tank, it appears black. The suspension, which is hotter than the hull but cooler than the engine compartment, appears in a different shade of green.

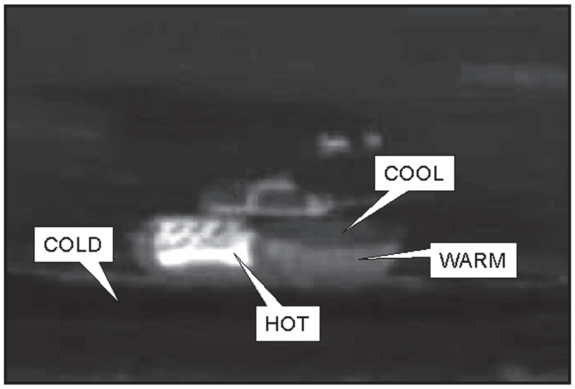


Figure E-7. Display of infrared levels.

NOTE: In the figures shown, the coldest objects appear black and the hottest appear white (bright green in the CLU). Everything in between appears as increasingly brighter shades of gray (shades of green in the CLU).

ΔT TO VISIBLE IMAGE

E-30. ΔTs occur between different objects in the target scene and between the different parts of a target. This technique allows the gunner to see different objects in the target scene, and to distinguish between different parts of a target (Figure E-8). For the gunner to see a target with the Javelin, a measurable ΔT which, for Javelin, is a difference between objects of 1 degree Fahrenheit or greater must exist between the target and its background (Figure E-9).

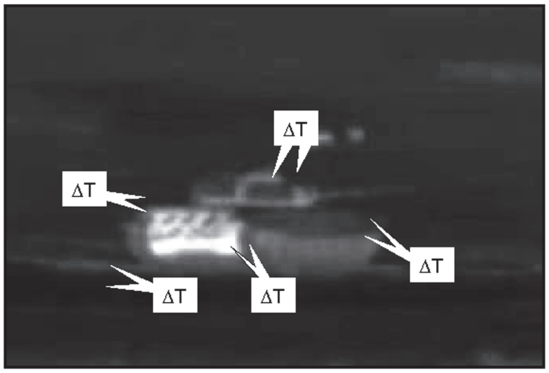


Figure E-8. ΔTs.

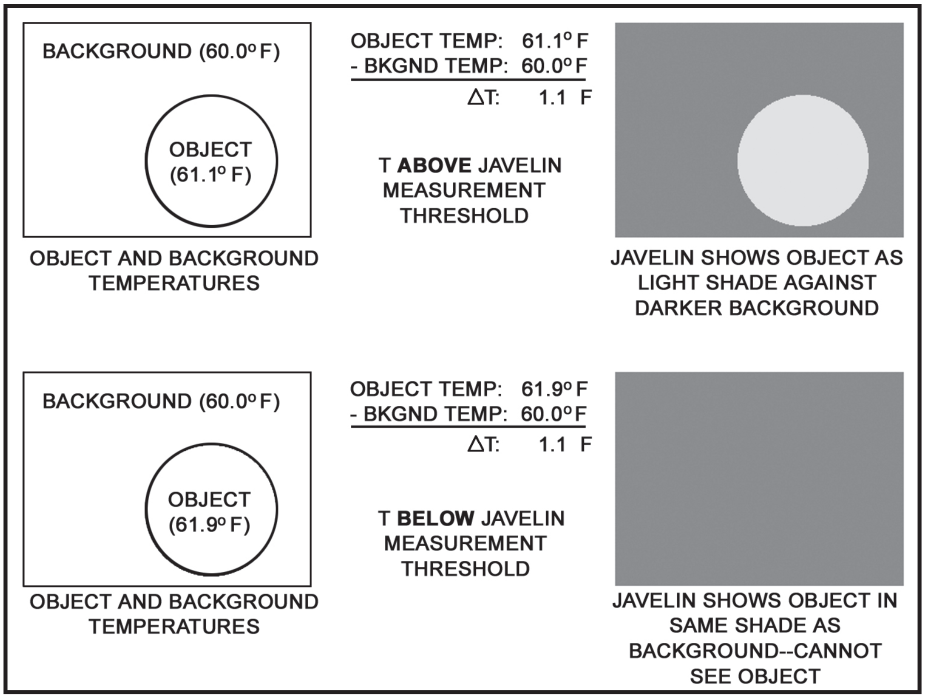

BACKGROUND (60.0º F)
OBJECT
(61.1º F)
OBJECT AND BACKGROUND
TEMPERATURES
OBJECT TEMP: 61.1º F
- BKGND TEMP: 60.0º F
ΔT: 1.1 F
T ABOVE JAVELIN
MEASUREMENT
THRESHOLD
JAVELIN SHOWS OBJECT AS
LIGHT SHADE AGAINST
DARKER BACKGROUND
BACKGROUND (60.0º F)
OBJECT
(61.9º F)
OBJECT AND BACKGROUND
TEMPERATURES
OBJECT TEMP: 61.9º F
- BKGND TEMP: 60.0º F
ΔT: 1.1 F
T BELOW JAVELIN
MEASUREMENT
THRESHOLD
JAVELIN SHOWS OBJECT IN
SAME SHADE AS
BACKGROUND--CANNOT
SEE OBJECT

Figure E-9. Measurable ΔT.

ΔTs Over a 24-Hour Period

E-31. The temperature relationship between one object and another changes during the day due to heating and cooling as the sun rises and sets.

E-32. The gunner knows that vehicles, buildings, and asphalt roads get hot in the sun. Grass and trees become warm but not so hot they cannot be touched. Large bodies of water do not warm up noticeably in one day. Objects that heat up the most during the day tend to become the coldest at night. Objects that heat up very little during the day tend to cool off very little at night (Figure E-10). To illustrate, two images are seen on the same terrain (one at noon and the other at midnight).

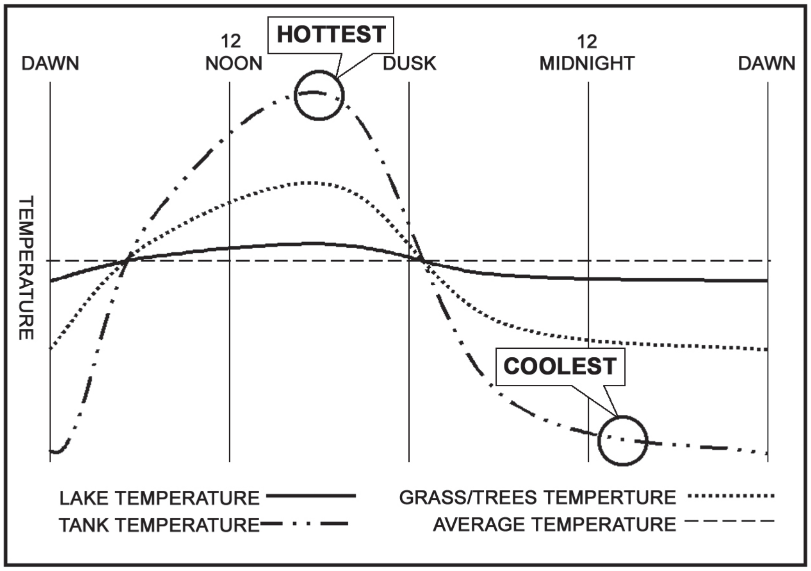


Figure E-10. Temperatures of objects during 24-hour period.

E-33. In the noon example (Figure E-11A), notice the buildings, roads, and vehicles are the hottest objects in the scene. The grassy areas and trees are shaded to indicate they are warm, and the river is black, which indicates it is the coolest object in the target scene.

E-34. In the midnight example (Figure E-11B), notice how the ΔTs changed. Now, the river is the warmest, the grass and trees are next, with the roads and vehicles being the coolest, with the exception of the engine compartment and exhaust on the vehicles. This example shows how the relationship of ΔTs changes among objects in a target scene over the course of a day.

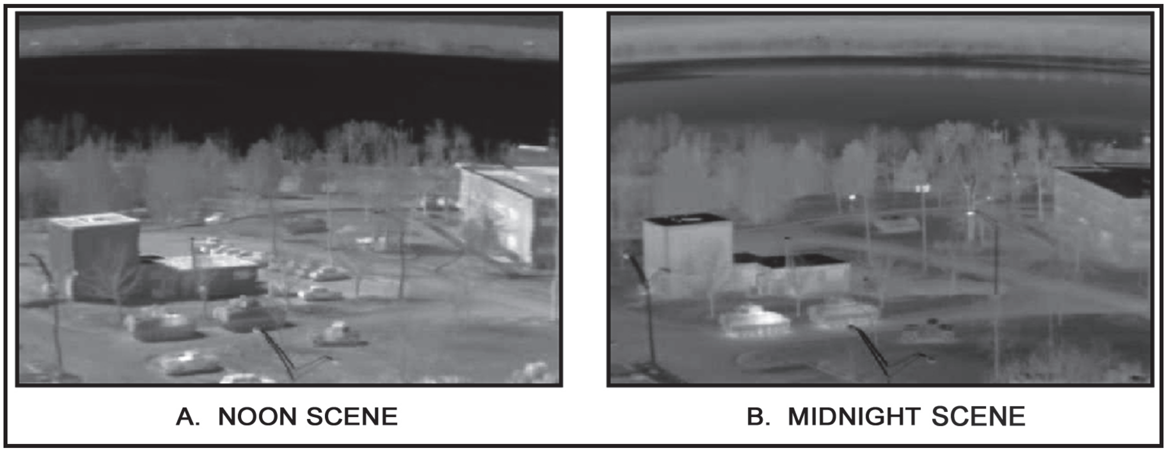


Figure E-11. ΔT changes from day to night.

Infrared Crossover

E-35. Twice a day, around dawn and dusk, the temperatures of the tank, grass, and trees cross over from being hotter than the river to being cooler (Figure E-12). These two periods are known as IR crossover because of the change in the temperature relationships and the visual effect that it produces. During these two periods, everything in the target scene is about the same temperature, which means there are few, if any measurable ΔTs. As shown earlier, when there is no measurable ΔT, the gunner cannot distinguish a target from its background.

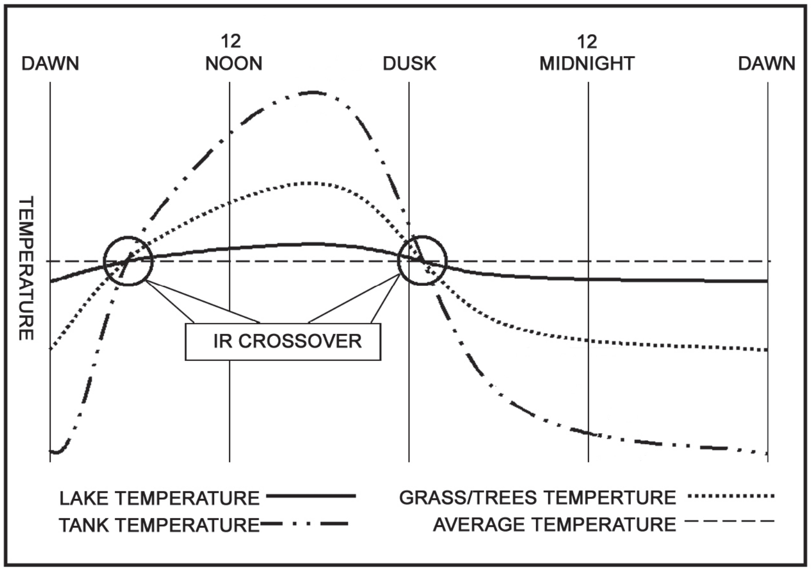


Figure E-12. Crossover periods.

INFRARED IMAGE ADJUSTMENT

E-36. Proper image adjustment is vital to accomplish the mission because it allows the gunner to see targets that may otherwise be hidden. There is no perfect image adjustment. Image adjustment is subjective and should be done according to what the gunner prefers.

FOCUS ADJUSTMENTS

E-37. The FOCUS switch adjusts NVS image focus. (An object is in focus when the gunner can easily identify its details or features.) Just like a camera, when an object is in focus in the NVS, anything closer or further away appears out of focus. When the gunner first uses the NVS after cooldown, he adjusts the focus before he adjusts the contrast and brightness. Otherwise, the edges of objects in the target scene are blurred, and the gunner is not able to adjust contrast and brightness properly (Figure E-13).

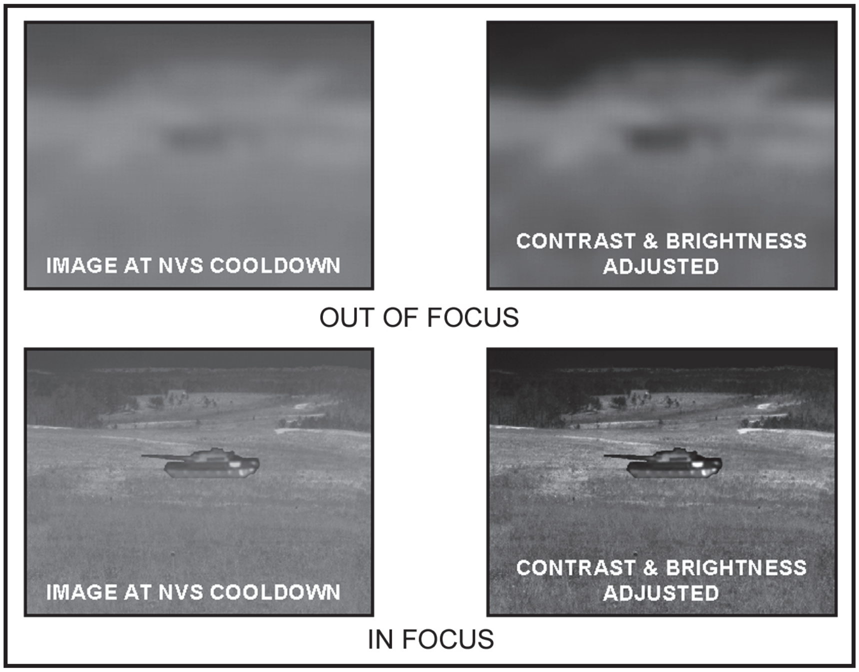


Figure E-13. Focus adjustments.

NOTE: Before focusing the NVS image, focus the CLU display with the diopter adjust ring.

Initial Adjustment

E-38. To adjust focus initially—

(1) Pick an object in the target scene, such as a far tree line.

(2) Press the FOCUS switch in either direction until the tree line is in focus (Figure E-14).

(3) If the tree line becomes more blurred, release the FOCUS switch and press it in the other direction.

NOTE: If adjusting the focus to either limit, the applicable FOV indicator (WFOV or NFOV) flashes to indicate the NVS is at a focus limit. Release the FOCUS switch and adjust it in the other direction.

(4) When the tree line comes into focus, release the FOCUS switch. If the focus adjustment overshoots, press the FOCUS switch back and forth to make minor adjustments.

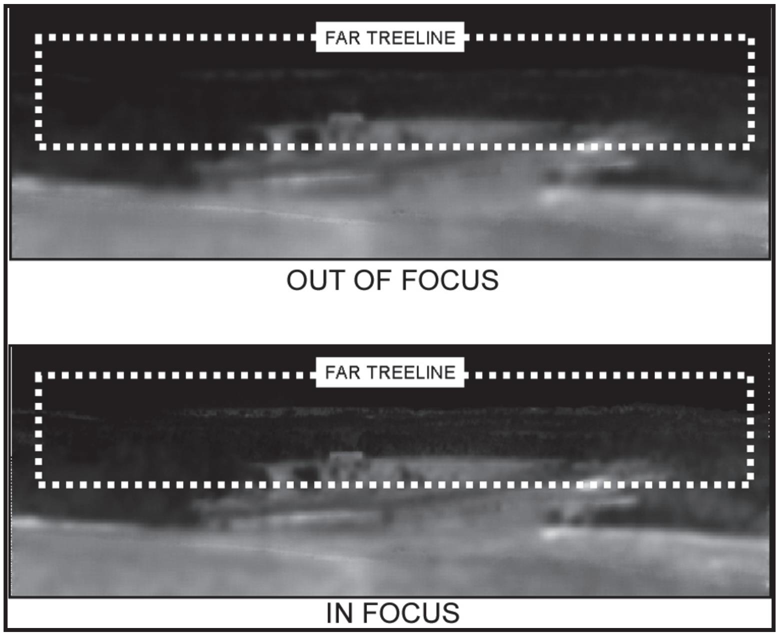


Figure E-14. Focus on far tree line.

Adjustment Speed

E-39. The NVS focus adjustment has two speeds available (press and release or press and hold).

Minor Adjustments

E-40. When the gunner presses and releases the FOCUS switch in either direction, the focus adjusts at a slow speed (Figure E-15). This procedure allows for fine-tuning the focus for a specific object.

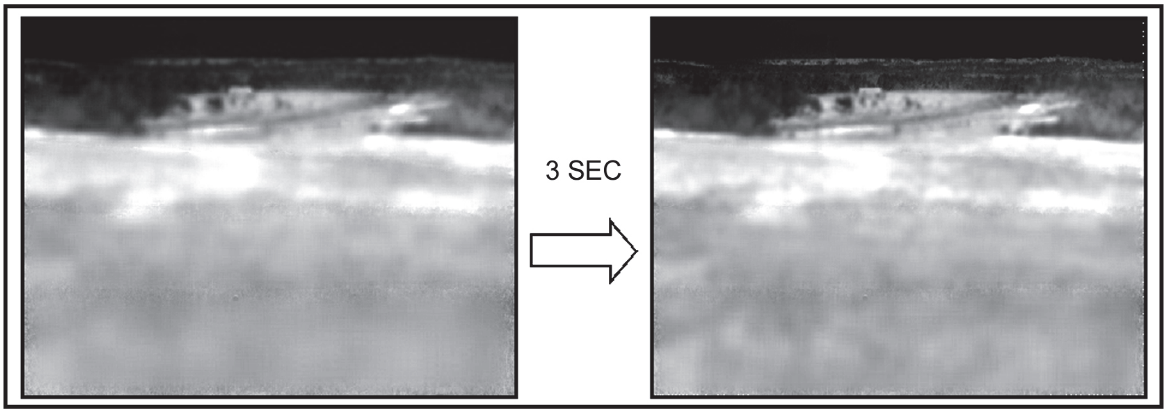


Figure E-15. Slow focus adjustment.

Major Adjustments

E-41. When the gunner presses and holds the FOCUS switch in one direction, the focus adjusts at a slow speed for the first three seconds. After that, focus automatically changes to high speed until the gunner either releases the switch or reaches a focus limit (Figure E-16). The high adjustment speed lets him focus quickly on another object that is much closer or much farther away.

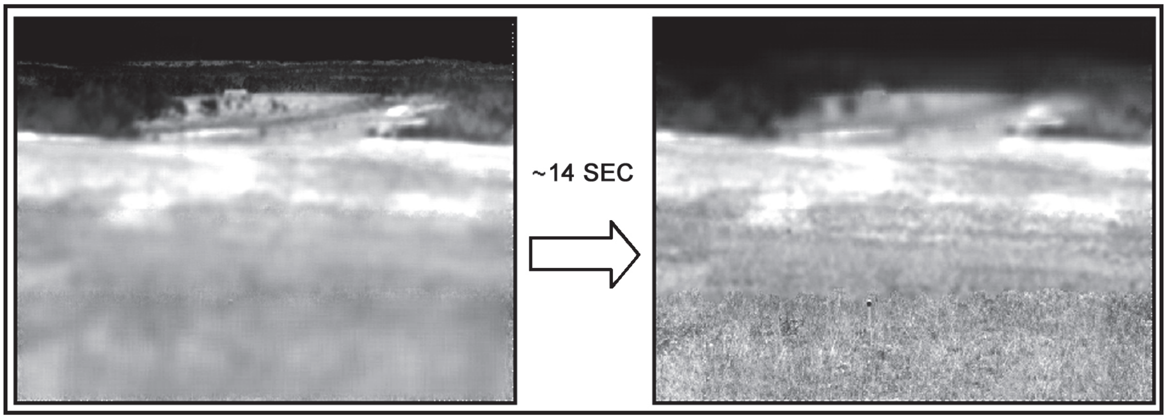


Figure E-16. Fast focus adjustment.

Focus Direction

E-42. To focus on objects farther away, press the FOCUS switch up (Figure E-17). To focus on objects that are near, press the FOCUS switch down.

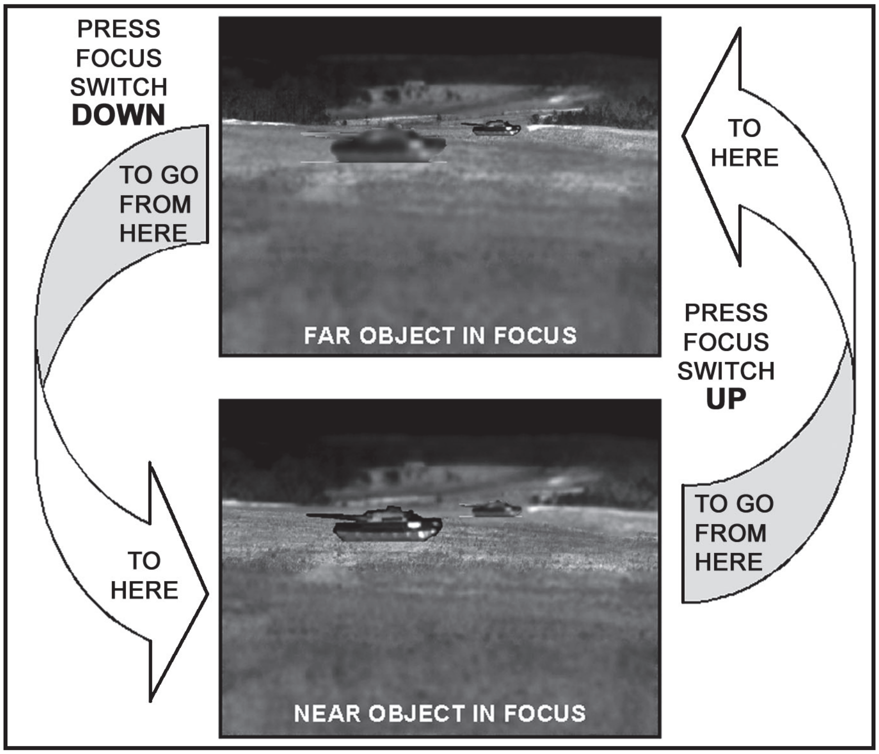

PRESS FOCUS SWITCH DOWN
TO GO FROM HERE
TO HERE
FAR OBJECT IN FOCUS
TO HERE
PRESS FOCUS SWITCH UP
TO GO FROM HERE
NEAR OBJECT IN FOCUS

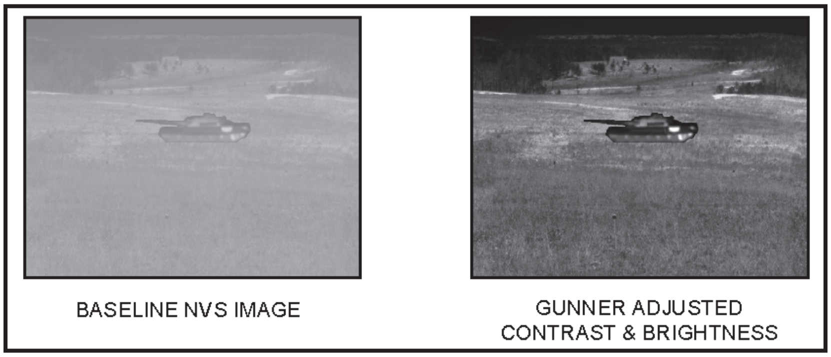
Figure E-17. Focus direction.

CONTRAST AND BRIGHTNESS ADJUSTMENT

E-43. Once the image is in focus, it may be necessary to adjust the contrast and the brightness. As the situation changes, the gunner adjusts the focus, the contrast, and the brightness to help in target acquisition.

Command Launch Unit Power-Up

E-44. When the power switch is turned to NIGHT and the NVS reaches cooldown, the NVS automatically adjusts contrast and brightness for the IR in the target scene (Figure E-18). This gives the gunner a baseline image for making an initial focus adjustment only. He still needs to fine tune the contrast and brightness according to the task.


BASELINE NVS IMAGE

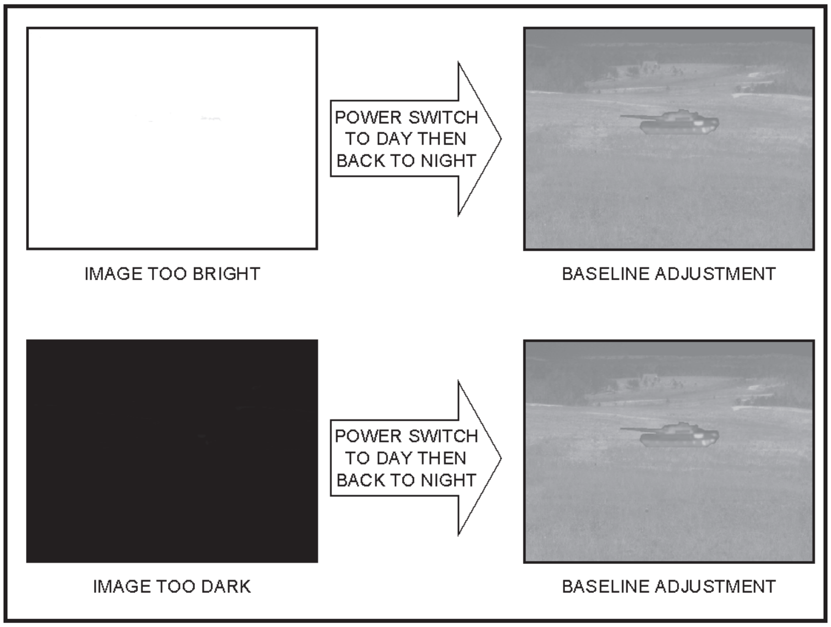
GUNNER ADJUSTED CONTRAST & BRIGHTNESS

Figure E-18. Night vision sight initial contrast and brightness baseline.

Contrast and Brightness

E-45. The gunner adjusts the contrast and the brightness to an extreme (all black or all bright green) and cannot readjust to obtain a usable image.

E-46. The gunner takes corrective action by turning the power switch to DAY, then back to NIGHT. The NVS adjusts itself to the baseline image (Figure E-19).


POWER SWITCH TO DAY THEN BACK TO NIGHT
POWER SWITCH TO DAY THEN BACK TO NIGHT
IMAGE TOO BRIGHT

BASELINE ADJUSTMENT

IMAGE TOO DARK

BASELINE ADJUSTMENT

Figure E-19. Return to baseline from an extreme contrast/brightness adjustment.

Good Adjustment

E-47. A properly adjusted target image is one in which the gunner sees a few black spots (the coldest objects) and a few bright green spots (the hottest objects) (Figure E-20). Everything else should be distributed across the shades of green.

E-48. Adjusting the brightness affects the contrast, and adjusting the contrast affects the brightness. The gunner adjusts one, then the other, in small increments, until he has a target image that looks good to him for the task he is doing.

E-49. If the gunner cannot tell whether to adjust the contrast or the brightness first because the entire screen appears bright green or the entire screen appears black, he adjusts the brightness first. If the gunner can see everything in the target scene, he adjusts the contrast first.

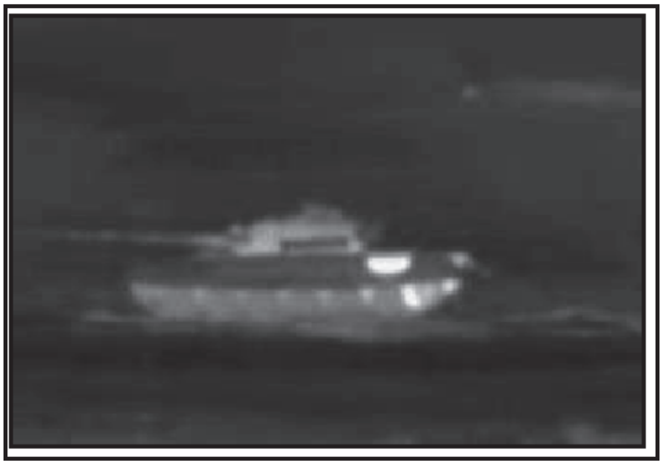


Figure E-20. Properly adjusted contrast and brightness.

Contrast Adjustment

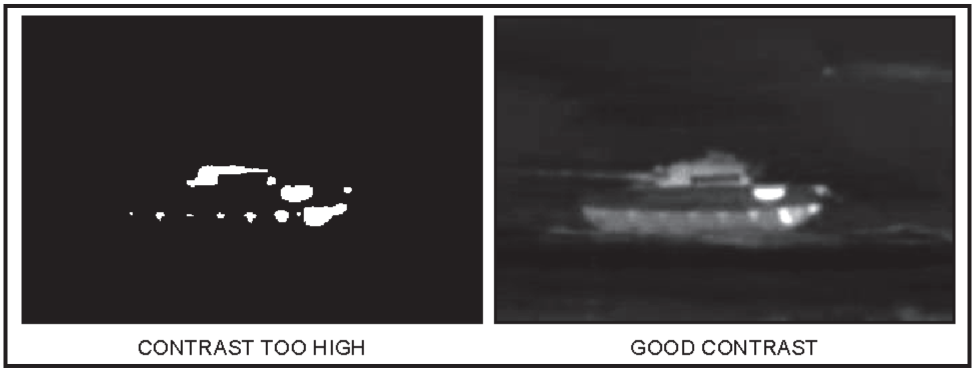
E-50. Contrast adjusts the difference between the bright green objects and the black objects with respect to the middle shades of green.

NOTE: In this manual, bright green objects in the CLU appear white in the figures used here. Objects that are shades of green in the CLU appear in shades of gray in the figures.

Contrast Too High

E-51. When contrast is too high (Figure E-21), all objects are adjusted away from the shades of green in the middle toward the two extremes, so they appear either bright green or black.

E-52. The gunner takes corrective action by decreasing the contrast by moving the GATE ADJ/CTRS & BRT switch left. This decrease brings objects back from the two extremes into the shades of green.



CONTRAST TOO HIGH

GOOD CONTRAST

Figure E-21. High versus good contrast adjustments.

Contrast Too Low

E-53. When contrast is too low (Figure E-22), all objects are adjusted into the shades of green in the middle away from the two extremes, so nothing appears black or bright green.

E-54. The gunner takes corrective action by increasing the contrast by moving the GATE ADJ/CTRS & BRT switch right. This increase spreads the objects out from the middle shades of green back toward the extremes of bright green and black.

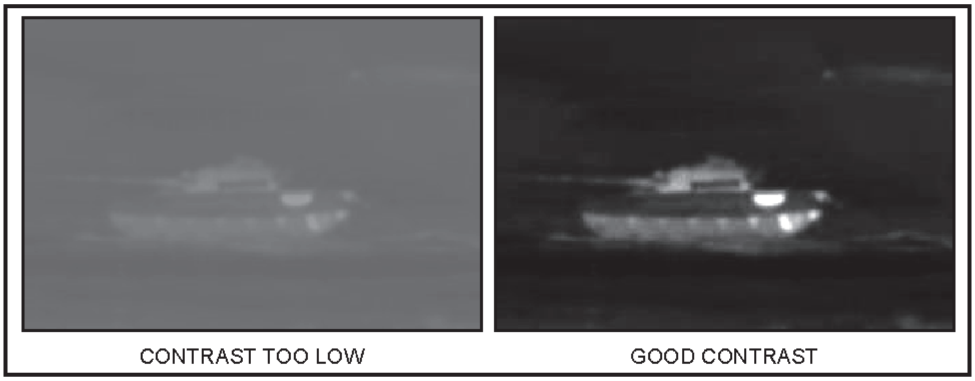


Figure E-22. Low versus good contrast adjustments.

Brightness Adjustment

E-55. Adjusting the brightness changes the intensity, or brightness, of the objects in a target scene in the same direction. Increasing brightness makes all objects brighter, and decreasing it makes them darker.

Brightness Too High

E-56. When the brightness is too high (Figure E-23), almost all objects in the target scene appear bright green, a few appear in shades of green, and none are black.

E-57. The gunner takes corrective action by decreasing the brightness by moving the GATE ADJ/CTRS & BRT switch down. This decrease drives down the intensity of all objects until some of them appear black.

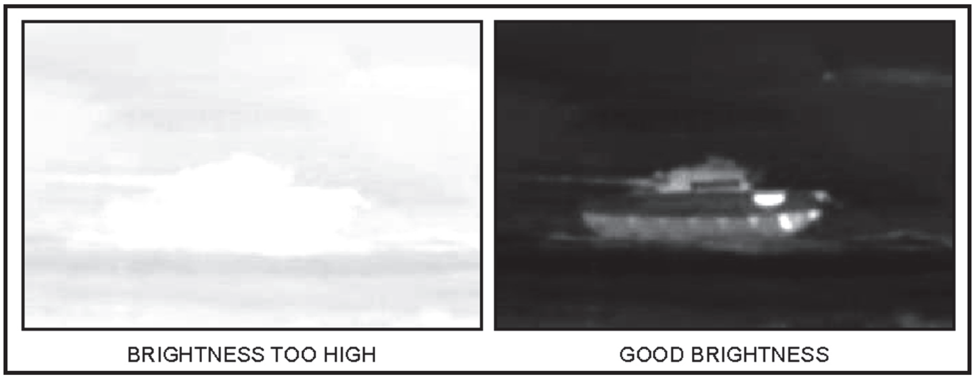


Figure E-23. High versus good brightness adjustments.

Brightness Too Low

E-58. When brightness is too low (Figure E-24), almost all objects appear black, a few appear as shades of green, and none appear bright green.

E-59. The gunner takes corrective action by increasing the brightness by moving the GATE ADJ/CTRS & BRT switch up. This increase drives up the intensity of all objects until some areas appear bright green.

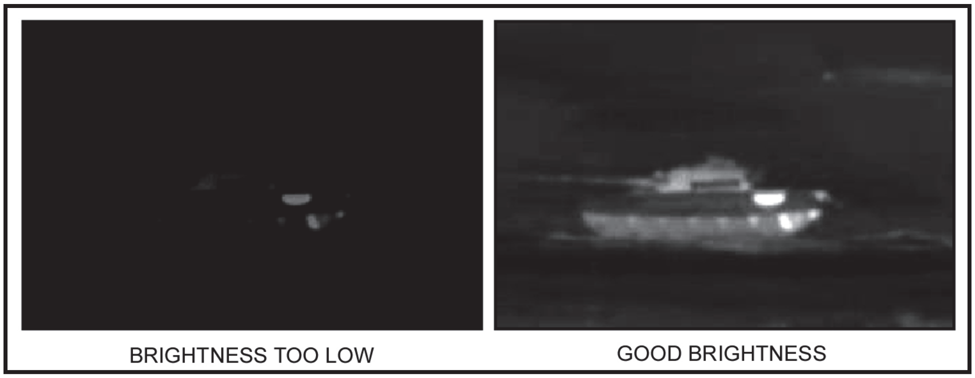

BRIGHTNESS TOO LOW
GOOD BRIGHTNESS

Figure E-24. Low versus good contrast adjustments.

FACTORS THAT AFFECT INFRARED TARGET IMAGES AND ΔTs

E-60. Conditions that affect the gunner's ability to acquire a target include limited visibility conditions, solar heating, human activity, and range to the target.

LIMITED VISIBILITY CONDITIONS (NATURAL AND MAN-MADE)

E-61. Rain, snow, sleet, fog, haze, smoke, dust, and darkness are referred to collectively as limited visibility conditions. These conditions affect the gunner's ability to acquire and engage targets with the Javelin especially when using day FOV (Figure E-25). The gunner uses the NVS to overcome darkness, haze, and some smoke systems.

E-62. The NVS can see through low levels of these obscurants better than the daysight. Its capability is restricted at higher levels of obscurations (Figure E-25). The effect on the NVS image is a decrease in contrast.

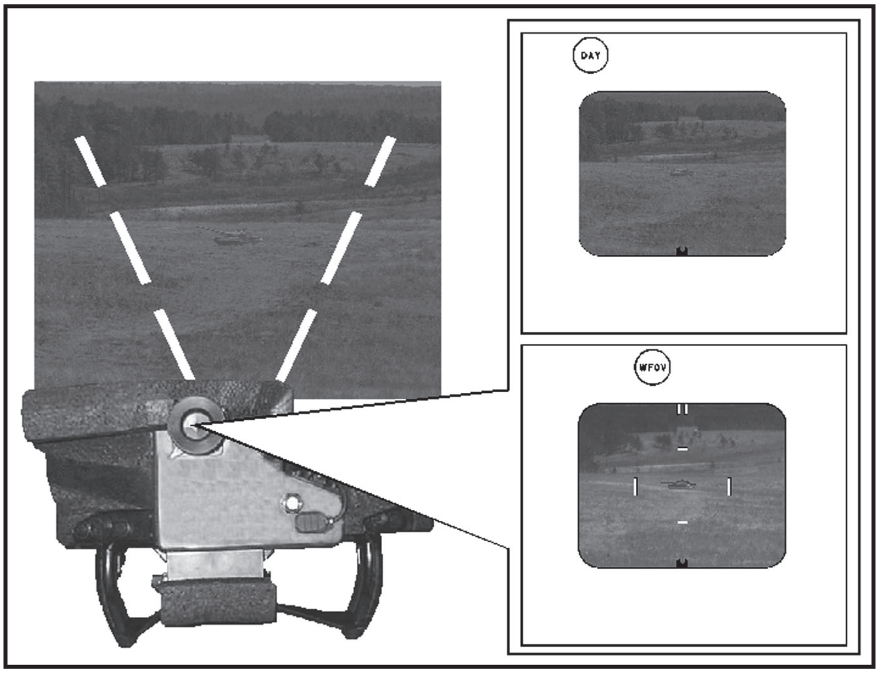


Figure E-25. Day vision sight versus night vision sight operation during high levels of obscuration.

SOLAR HEATING

E-63. Solar heating is the single greatest influence on the target scene ΔT changes. Solar heating also causes IR clutter and IR crossover, both of which can restrict the gunner's ability to engage a target.

Weather

E-64. Weather can greatly change the amount of solar heat on objects. Objects observed during clear weather have good ΔTs due to the high amount of solar heating. In addition, the objects can change their appearance during a 24-hour period. During periods of precipitation (snow, rain, sleet, and so forth), there is little solar heating and the ΔTs are low.

Infrared Clutter

E-65. IR clutter is a term used to describe a pattern of ΔTs in the target scene that prevents the gunner from distinguishing a target from its background. This pattern is similar to the effect that is attempted when a Soldier wears the Army combat uniform (ACU). The reason ACUs have a certain color pattern is the ACU pattern blends with the background, cluttering the gunner's outline and making it difficult for an enemy to see him.

E-66. IR clutter can be natural or man-made, and there are several differences between the two including cause or origin, effect on the target scene, area of coverage, time and location of appearance, and temperature of the clutter objects relative to the target.

E-67. The sun creates natural IR clutter, which generally covers large areas of terrain, such as a field, scattered rocks, or a hillside, which is a disadvantage when trying to engage a target. (This clutter can prevent the gunner from seeing a target and its movement with the NVS, but not with the daysight.) Natural clutter is unpredictable, so the gunner cannot tell if or when the target is visible. The gunner needs to pay attention to areas of clutter so he can keep track of moving targets that enter these areas. Natural clutter is caused either by solar heating or by IR reflecting off objects in the target scene.

Clutter From Solar Heating

E-68. When solar heating causes clutter, the clutter stays in the same place and keeps the same appearance for a long time. ΔTs are present in the target and in the background, but the two ΔT patterns match so closely that the gunner may not be able to distinguish the target from the background (Figure E-26). In addition, the range of temperatures in the clutter is the same as those in the target.

E-69. The gunner can first adjust the contrast and the brightness. He may find that contrast and brightness adjustments do not bring out the target from its background. In that case, the gunner must wait for the target to move out of the clutter or wait for the ΔTs to change.

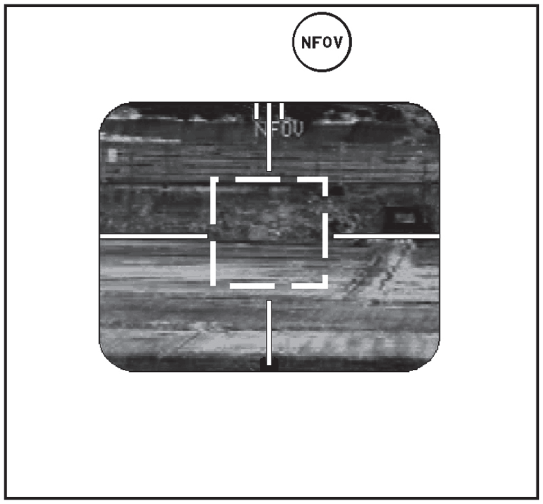


Figure E-26. Infrared clutter—background ΔT pattern matches target ΔT pattern.

Clutter From Reflected Infrared

E-70. When reflected IR causes IR clutter, the clutter comes and goes randomly with the appearance of the sun, and at different locations. (This can cause the gunner to suddenly lose a target that was visible or make a target appear suddenly that was hidden from him.) Its appearance is such that the target and the clutter look like one large area of uniform temperature (Figure E-27).

E-71. Generally, a gunner can defeat this type of clutter by increasing the contrast and decreasing the brightness. If not, he must wait for the target to move out of the clutter or wait for the ΔTs to change.

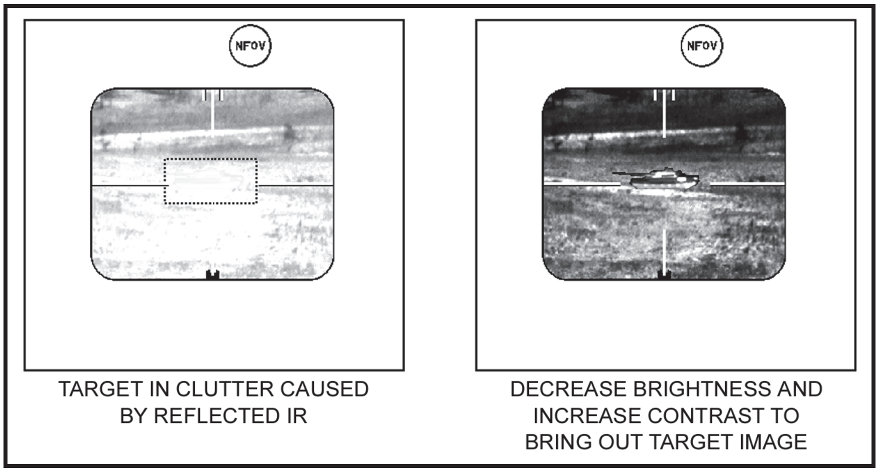

NFOV
NFOV
TARGET IN CLUTTER CAUSED BY REFLECTED IR
DECREASE BRIGHTNESS AND INCREASE CONTRAST TO BRING OUT TARGET IMAGE

Figure E-27. Defeating clutter caused by reflected infrared.

E-72. Although natural IR clutter can prevent the gunner from seeing the target, it usually occurs during the day when the daysight sight works well for surveillance. However, if he cannot see the target with the NVS, the gunner will not be able to see it with the seeker either.

Man-Made Infrared Clutter

E-73. Man-made clutter exists when conditions influenced by human activity affect objects in the target scene. When an enemy vehicle (the target) is in an area with burning vehicles or buildings, the vehicle may be able to use the flames to hide, thus making it difficult for the seeker to obtain a lock-on. However, based on the ΔTs, the gunner may be able to detect the target (Figure E-28).

E-74. The gunner must change the contrast and brightness based on the appearance of the target. The gunner should start by adjusting the brightness first (Figure E-29), then the contrast (Figure E-30). The gunner does this until he has a good target scene. Although the gunner may be able to counter the effects of IR clutter in the NVS (WFOV or NFOV) by adjusting the contrast and brightness, he may not be able to see the target in seeker FOV. If the corrective action does not work the target scene and allow the gunner to acquire the target, he should do the following:

- Wait for the target to leave the area of IR clutter.
- Wait for the target to change in temperature, and then try to engage the target.
- Wait for the objects causing the IR clutter to change in temperature, and then try to engage the target.

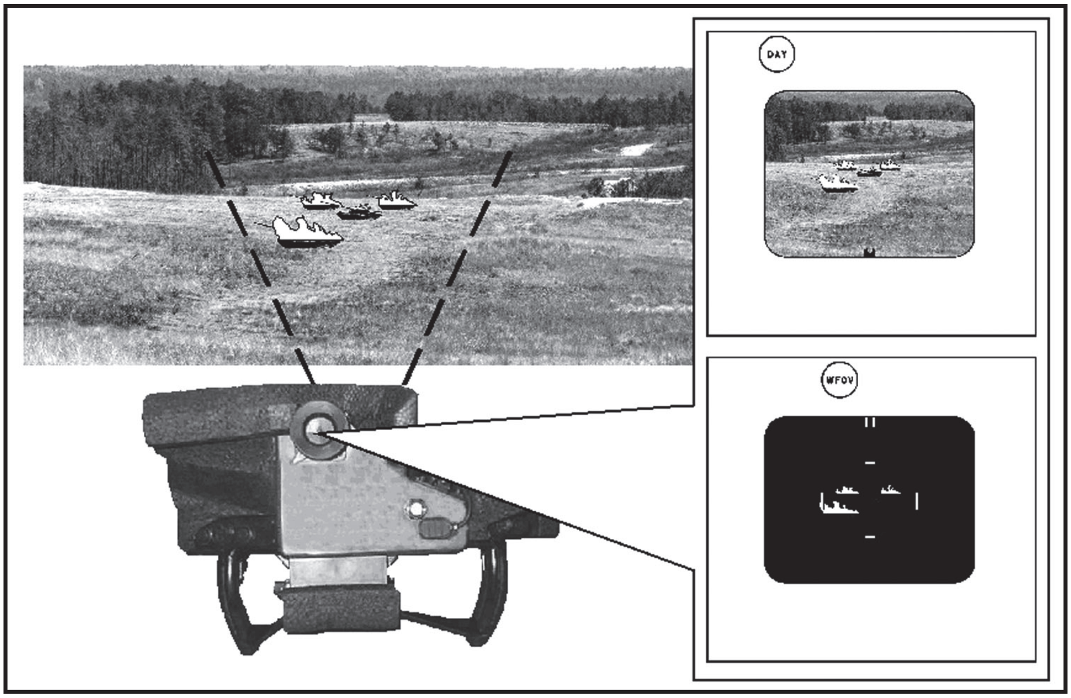


Figure E-28. Effects of man-made clutter on night vision sight target scene.

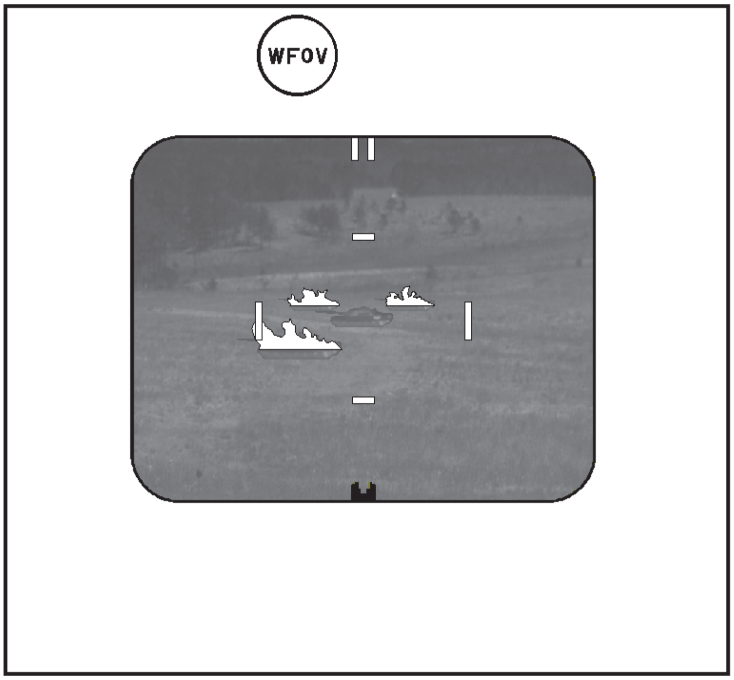


Figure E-29. Counteracting man-made clutter Step 1—adjust brightness.

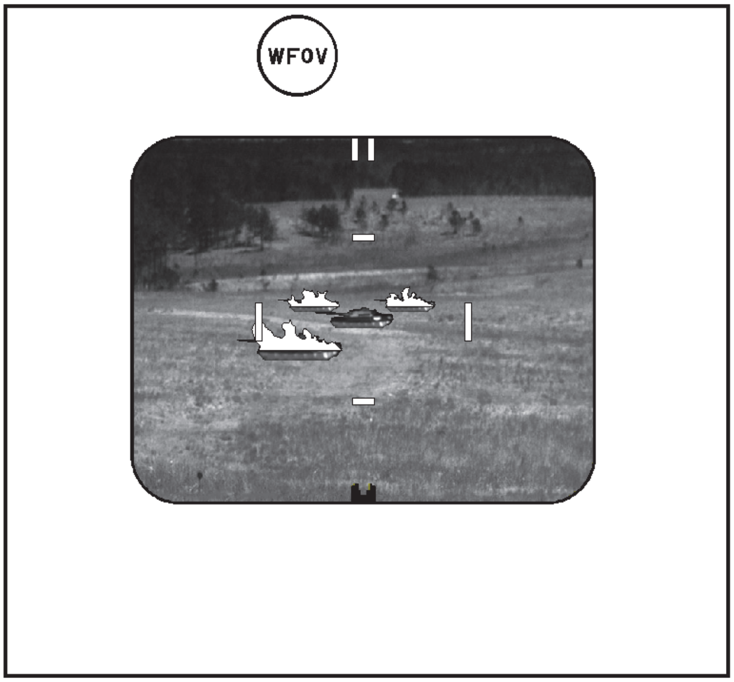


Figure E-30. Counteracting man-made clutter Step 2—adjust contrast.

Infrared Crossover

E-75. IR crossover prevents the gunner from seeing the target because everything in the target scene (the background terrain and the target) is about the same temperature. This occurs twice in a 24-hour period at dawn and again at dusk. During this time, the target is nearly the same temperature as its background, so the ΔT between the target and its background is low (Figures E-31). The Javelin detects ΔTs as low as 1 degree Fahrenheit.

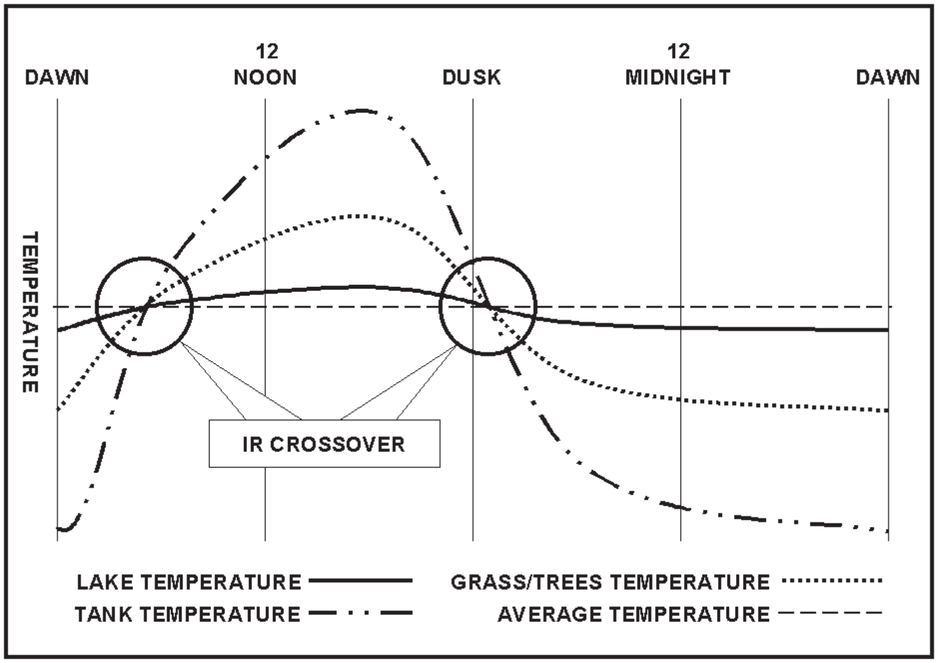
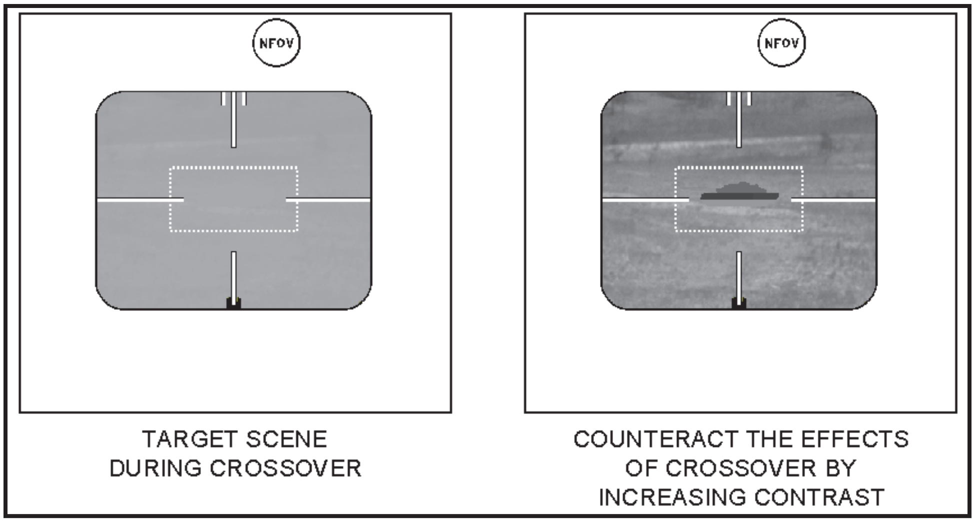


Figure E-31. Infrared crossover times.

E-76. The gunner can use this capability to overcome the effects of crossover by adjusting contrast and brightness. In addition, crossover will not occur for all parts of the target at the same time. Part of the target will always have a measurable ΔT between it and the background so the gunner can determine the target's location (Figure E-32).



NFOV
NFOV
TARGET SCENE DURING CROSSOVER
COUNTERACT THE EFFECTS OF CROSSOVER BY INCREASING CONTRAST

Figure E-32. Infrared crossover effects.

Human Activity

E-77. Human activity has an effect on the amount of IR in objects in the target scene, which disrupts the natural changes that should occur in their IR images. For example, at night, vehicles and asphalt roads should appear dark green. When a vehicle is driven for a while, it appears bright green around the engine, exhaust, and suspension as a direct result of human activity. When enough vehicles drive on a road, it will appear as light green where wheel or track friction causes the road surface temperature to increase (Figure E-33).

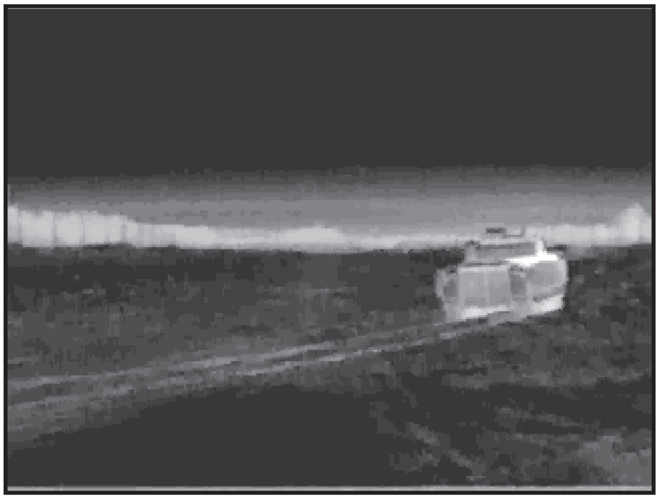


Figure E-33. Road temperature increases due to friction from vehicle tracks.

Range to Target

E-78. The gunner's ability to distinguish a target at maximum range from its background is restricted due to limitations of the NVS magnification, image resolution, and obscurants. When the target moves toward the gunner, the clarity of target details increases as range to the target decreases (Figure E-34).

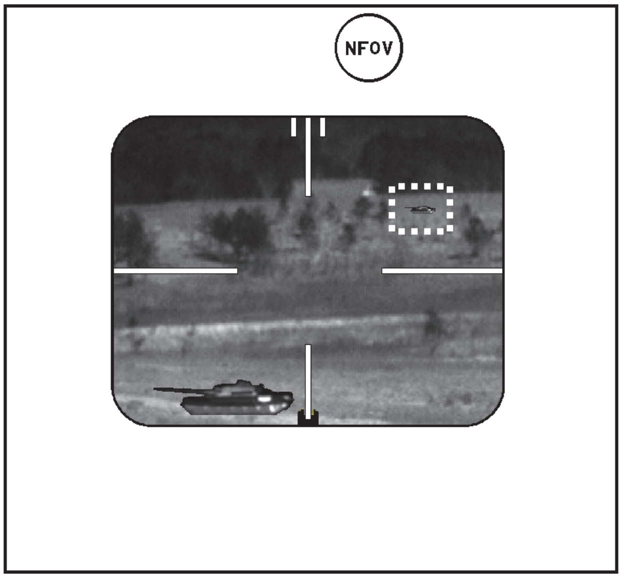


Figure E-34. Effects of range on target details.

TARGET ACQUISITION

E-79. Target acquisition consists of target detection, classification, recognition, and identification, (Figure E-35). Each step has a specific FOV associated with it. These FOV steps allow the gunner to progress efficiently into target engagement. The first three steps are discussed in the target acquisition process only. Target identification is taught at the unit level. Various media is available to assist the unit in this training.

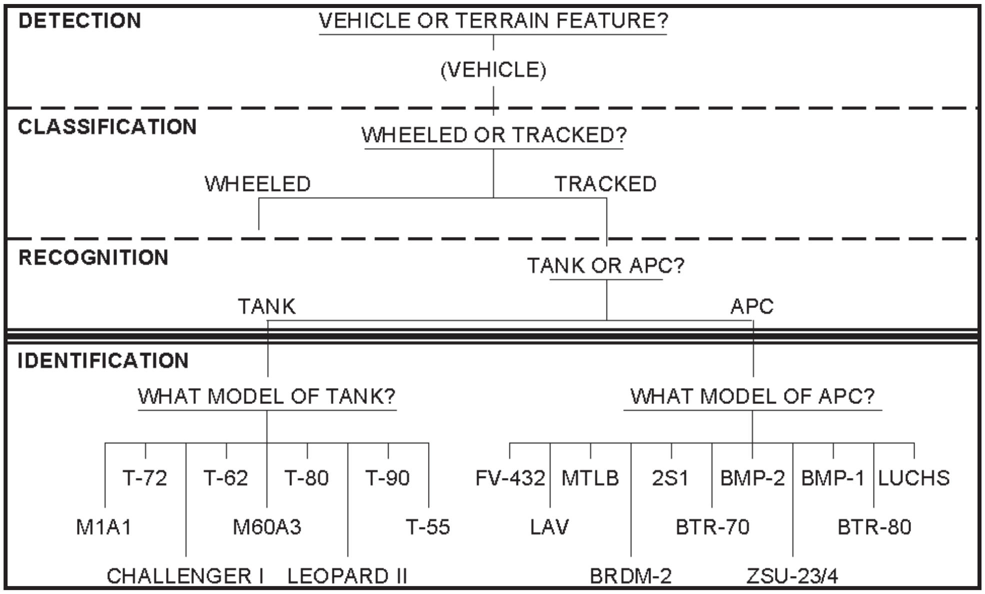

DETECTION
VEHICLE OR TERRAIN FEATURE?
(VEHICLE)
CLASSIFICATION
WHEELED OR TRACKED?
WHEELED
TRACKED
RECOGNITION
TANK OR APC?
TANK
APC
IDENTIFICATION
WHAT MODEL OF TANK?
WHAT MODEL OF APC?
T-72
T-62
T-80
T-90
M1A1
M60A3
T-55
CHALLENGER I
LEOPARD II
FV-432
MTLB
2S1
BMP-2
BMP-1
LUCHS
LAV
BTR-70
BTR-80
BRDM-2
ZSU-23/4

Figure E-35. Target acquisition steps.

FIELD-OF-VIEW SEQUENCE

E-80. As the gunner detects, classifies, and recognizes a target, then, determines its engageability, he must change the FOV, as the task requires. The FOV sequence is day FOV, WFOV, NFOV, and seeker FOV (Figure E-36).

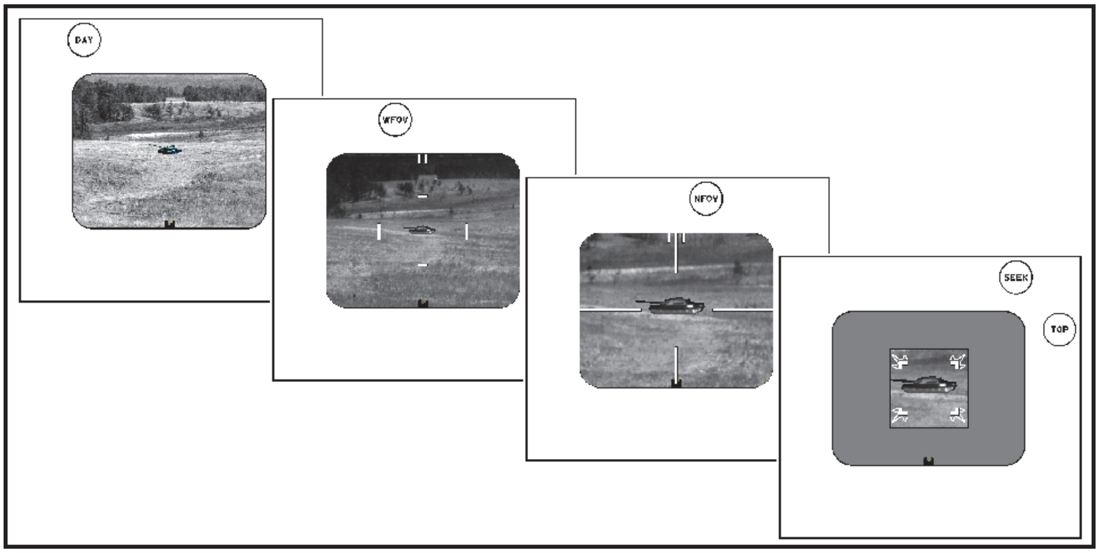

DAY
WFOV
NFOV
SEEK
TOP

Figure E-36. Target engagement field-of-view sequence.

Day Field-of-View

E-81. Day FOV provides a full-color, visible-light target image with 4x magnification (Figure E-37). Day FOV imagery is only useful during daylight hours with clear weather. The gunner should use it primarily during NVS cooldown or when the IR conditions make it difficult for him to see the target in the NVS. Day FOV covers a large area and is used primarily for surveillance and target detection. The 4x magnification limits the gunner's ability to make out target details that are required for target classification, recognition, and identification. However, the gunner may activate the seeker in this FOV to perform a quick engagement.

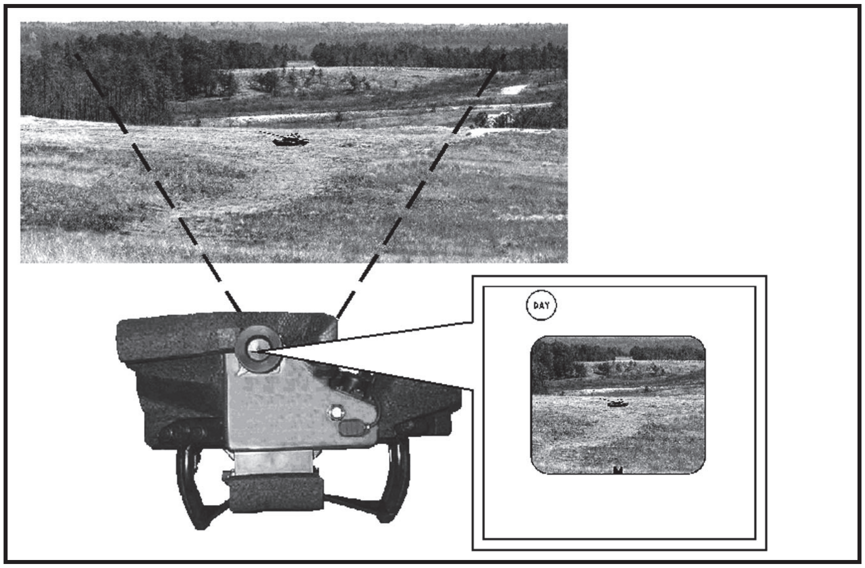


Figure E-37. Day field-of-view image and area of coverage.

Night Vision Sight

E-82. The NVS provides two fields of view: WFOV and NFOV. Both provide IR images and can be used at any time of day under any weather conditions. The NVS is the gunner's primary sight.

Wide Field-of-View

E-83. WFOV provides 4.2x magnification of the target scene (Figure E-38). WFOV is ideal for use during surveillance and target detection due to its large area of coverage. The low magnification means the gunner cannot see the target details very well, which makes it a poor tool for target classification, recognition, and identification.

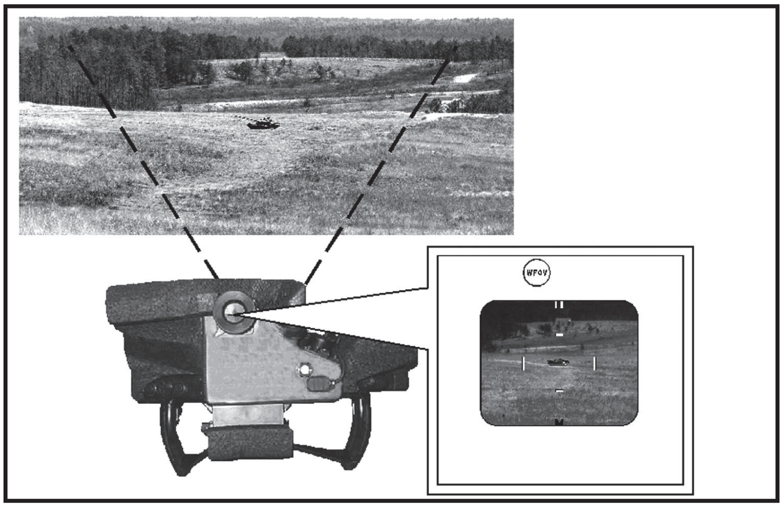


Figure E-38. Wide field-of-view image and area of coverage.

Narrow Field-of-View

E-84. NFOV provides about 9x magnification of the target scene (Figure E-39). Its higher magnification means that NFOV is useful for seeing target details for target classification, recognition, and identification. At the same time, the restricted area of coverage makes it difficult to use for target detection.

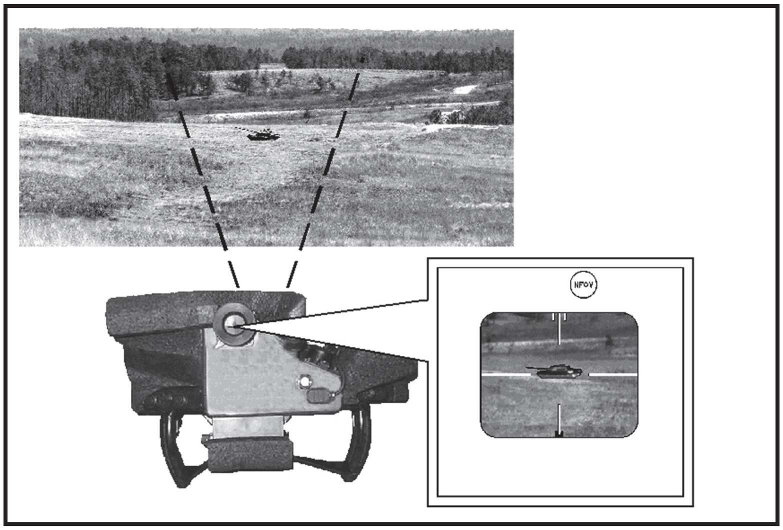


Figure E-39. Narrow field-of-view image and area of coverage.

Seeker Field-of-View

E-85. Seeker FOV provides an IR image with about 9x magnification (Figure E-40). The seeker FOV has a limited coverage area and image resolution, and should be used only for engaging targets.

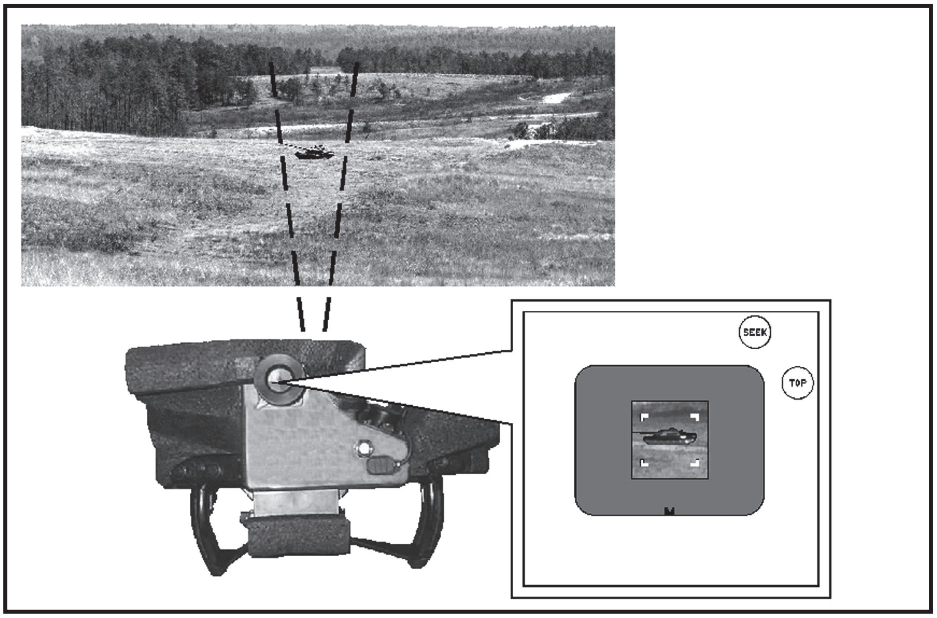


Figure E-40. Seeker field-of-view image and area of coverage.

TARGET DETECTION

E-86. The first step in the target acquisition process is target detection (Figure E-41). During this step, the gunner scans his sector of fire to find or acquire a target using the CLU, mainly the NVS. Some techniques that help detect targets are discussed in the following paragraphs.

DETECTION

VEHICLE OR TERRAIN FEATURE?

(VEHICLE)

Figure E-41. Target acquisition—detection.

Definition

E-87. Target detection describes the process by which the gunner visually locates and distinguishes the features of a vehicle from the surrounding terrain features.

Scanning for Targets

E-88. The gunner should—

- Scan the entire sector of fire using WFOV.
- Scan slowly and steadily in a consistent, systematic pattern.
- Pay special attention to those positions in which a target might appear.
- Identify the location of objects, such as TRPs, trees, roads, buildings, and previously killed targets that have a distinct IR signature. This procedure enables the gunner to quickly locate targets in his sector of fire.
- Look for man-made shapes that have straight lines and block angles.

Scanning Techniques

E-89. The gunner must scan his sector of fire at all times for the enemy using rapid scan, slow scan, and detailed search.

Rapid Scan

E-90. The rapid scan search technique (Figure E-42) is used to detect obvious signs of enemy activity. It is usually the first method the gunner uses. To conduct a rapid scan—

- Search a strip of terrain about 100 meters deep, from left-to-right, pausing at short intervals.
- Search another 100-meter strip farther out, from right to left, overlapping the first strip scanned and pausing at short intervals.
- Continue this method until the entire sector of fire has been searched.

Slow Scan

E-91. The slow scan search technique uses the same process as the rapid scan but much more deliberately, which means a slower side to side movement and more frequent pauses. When a possible target has been detected, stop and search the immediate area thoroughly using the detailed search.

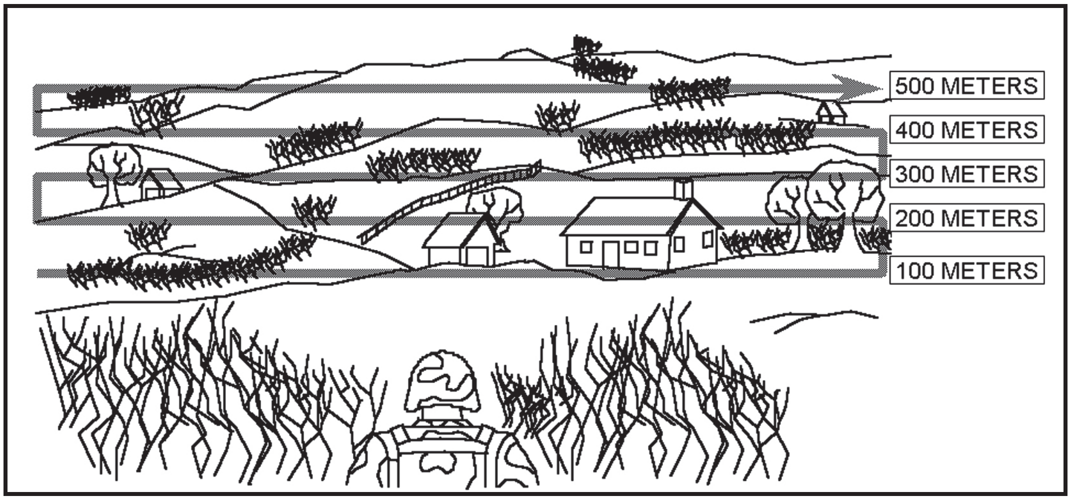


Figure E-42. Rapid/slow scan pattern.

Detailed Search

E-92. If the gunner finds no targets using either the rapid or slow scan techniques, he makes a careful, detailed search of the target area using NFOV (Figure E-43). The detailed search is like the slow scan, but searching smaller areas with frequent pauses and almost incremental movement. The detailed search, even more than the rapid or slow scan, depends on breaking a larger sector into smaller sectors to ensure everything is covered in detail and no possible enemy positions are overlooked.

- Concentrate on likely vehicle positions and suspected AAs.
- Look for target signatures around prominent terrain features, such as road junctions, hills, and lone buildings. Also, look at areas with cover and concealment, such as tree lines and draws.

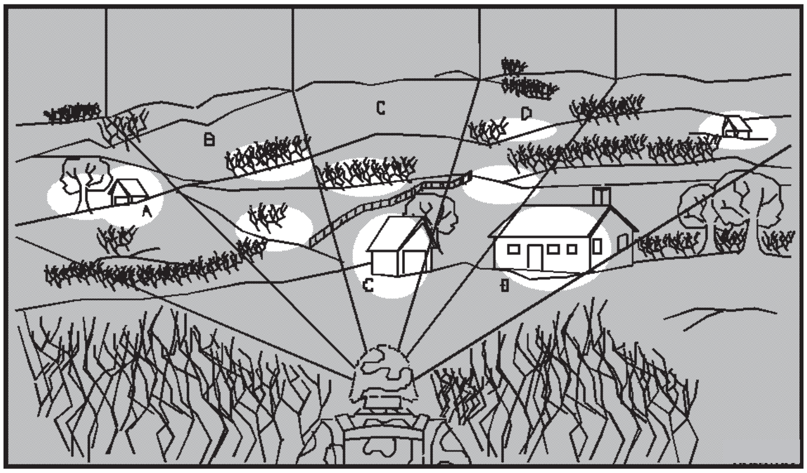


Figure E-43. Detailed search.

DEFENSIVE OPERATIONS (MOVING TARGETS)

E-93. When trying to detect the enemy, the gunner should look and listen for signs of enemy presence:

Dust or Vehicle Exhaust

E-94. Moving vehicles often raise dust. Stay alert for dust because it can be spotted at long ranges (Figure E-44).

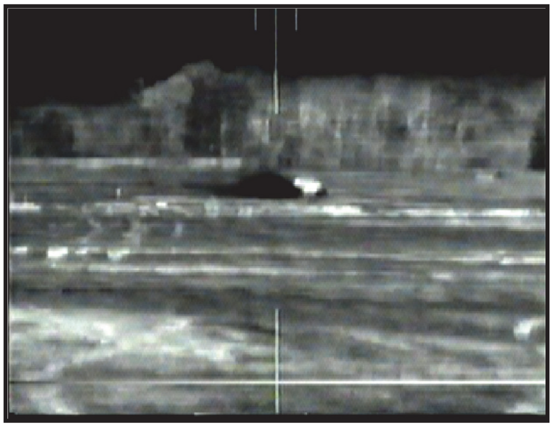


Figure E-44. Dust cloud from moving vehicle.

Vehicle Movement

E-95. Look for enemy movement along high-speed AAs. Search along terrain features that offer masking, such as tree lines and draws.

Flashing Hot Spots

E-96. As a vehicle moves over small gullies and hills at a distance, its hot spots appear to be flashing and appear to become visible, then invisible as the vehicle drops below the observation line.

Sounds

E-97. Equipment or vehicle sounds can alert the gunner to the direction or general location of the enemy. These sounds may not pinpoint the enemy's exact location, but if a sound alerts the gunner to a general area, he is more likely to spot the enemy in that area using the detailed search technique.

Image Adjustment

E-98. The gunner can spot moving targets easily due to the hot signatures from the suspension, engine compartment, and exhaust, and due to the changes in the target aspect as the target moves in his sector of fire. When the gunner is in a defensive position, he adjusts the image so he can see all of the terrain features (Figure E-45). This procedure helps him locate any targets moving in his sector of fire.

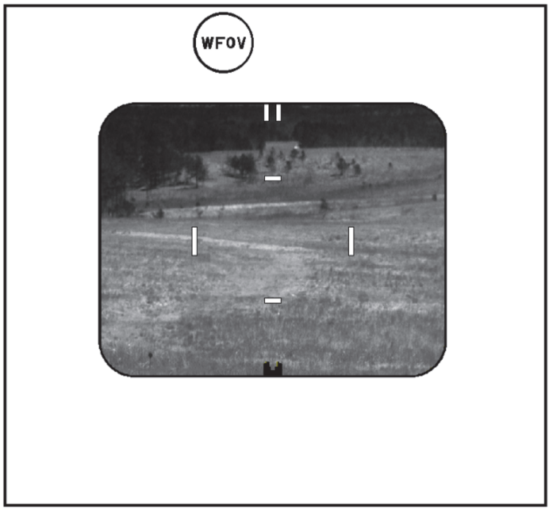


Figure E-45. Image adjustment for defensive position.

OFFENSIVE OPERATIONS (STATIONARY TARGETS)

E-99. During offensive operations, the gunner may encounter stationary targets. A stationary target is more difficult to detect than a moving target, because it does not give away its location by moving, but can be partly or completely concealed by a terrain feature. Key IR signatures may be cold. Depending on how long the target has been stationary, the gunner may see hot, cold, or partly cool signatures. The IR image of a hot, stationary target is much easier to detect than that of a cold, stationary target (Figure E-46). The gunner can augment his visual search to find an enemy emplacement. The difficulty in detecting a target is directly affected by the temperature of the surrounding terrain.

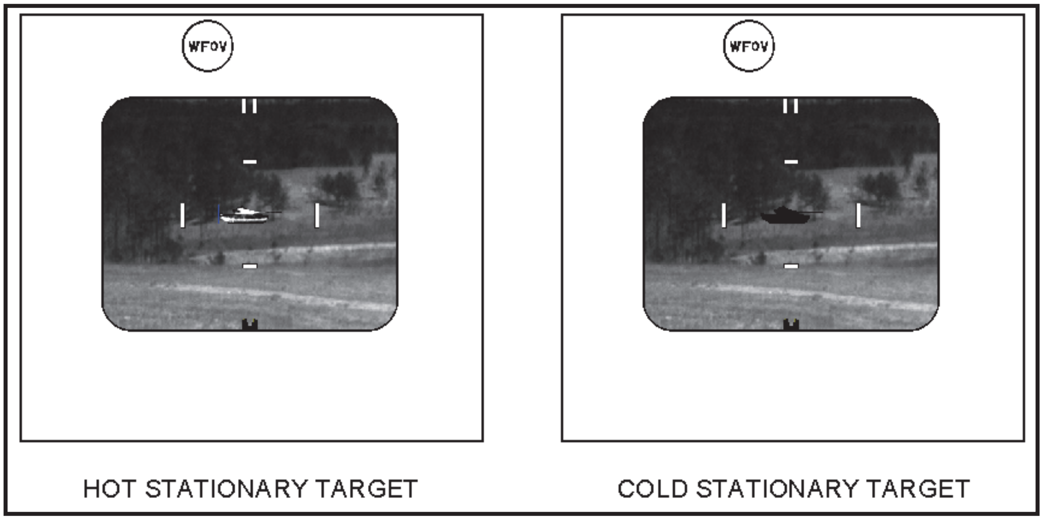


Figure E-46. Hot and cold stationary targets.

Sounds

E-100. Listen for equipment and vehicle sounds.

Vehicle Exhaust

E-101. Be alert to the presence of vehicle exhaust. Tanks need their engines started every few hours to charge the batteries, which creates a large plume of exhaust (Figure E-47) and a distinctive smell, which may linger even after the engine has been turned off.

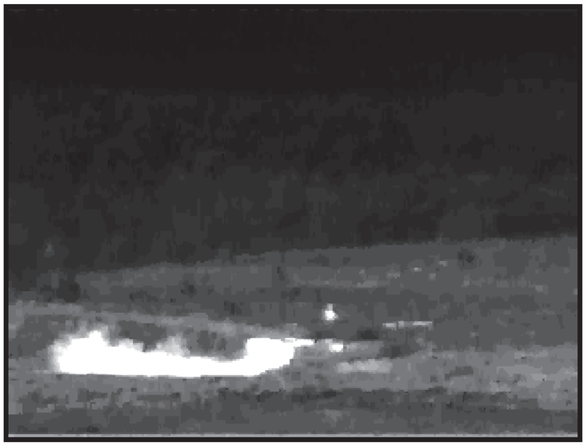


Figure E-47. Vehicle exhaust.

Dismounted Troops

E-102. The human body is a good IR source, and appears as a hot image. Watch for dismounted troop movement (Figure E-48) that can give away the position of a mechanized force.

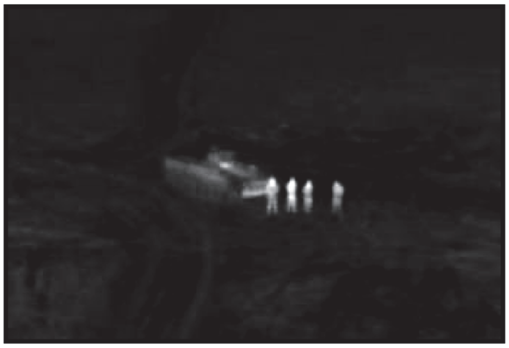


Figure E-48. Dismounted troops as infrared source.

Vehicle Positions

E-103. Look for enemy positions in obvious places, such as road junctions, hilltops, and lone buildings. Observe areas with cover and concealment, such as wood lines and draws.

Image Adjustment

E-104. The gunner may have to adjust the image several times to detect stationary targets due to various circumstances and examine the following:

- In what aspect (frontal or flank) the gunner sees the targets, which affects what IR signatures he is able to see.
- If the targets are partly hidden by a terrain feature, such as when it is in defilade or in a tree line.
- Whether targets are hot from recent activity or solar heating, partly cool due to reduced activity, or cold due to long inactivity.

HOT STATIONARY TARGETS

E-105. Hot stationary targets are the easiest to detect. When a stationary target has hot signatures, the gunner can assume there has been recent activity or solar heating. To find hot signatures easily, adjust contrast up and brightness down so that only the hottest signatures appear in the FOV, and the rest of the scene is black (Figure E-49). When the gunner thinks he has detected a target, he adjusts the contrast and brightness so he can see the rest of the target's features. Depending on the target's exposure and aspect, some of the signatures to look for include the suspension system, engine compartment/exhaust, gun tube or barrel, and an indirect signature called backlighting.

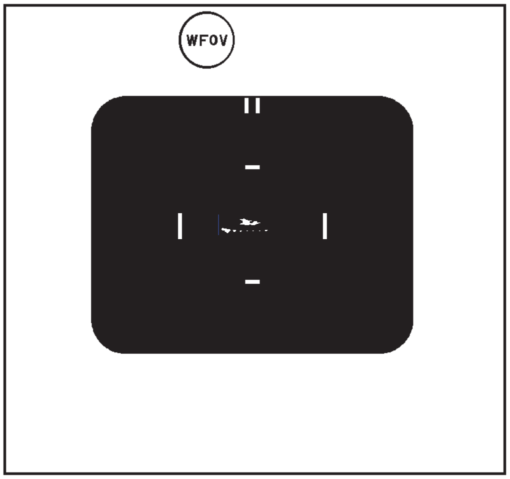


Figure E-49. Image adjustment for detecting hot stationary targets.

Suspension System

E-106. When a target has moved recently, its suspension presents a hot IR signature. The track area presents hot spots due to heating from friction. When viewed from the front, the tracks are normally visible as two IR signatures on either side of and below a larger dark area (the hull) (Figure E-50). If viewed from the flank, the tracks and road wheels normally are visible as a hot signature beneath a larger dark area (the hull).

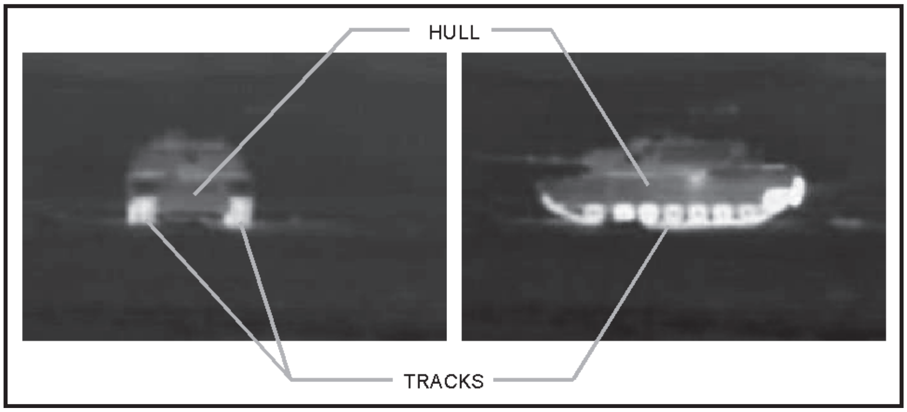


Figure E-50. Track and hull signatures.

Engine Compartment

E-107. The engine compartment (Figure E-51) is usually a reliable IR signature for the following reasons: Due to the extreme heat generated by the engine and the large mass of metal of which it is made, a stationary vehicle's engine compartment gives off a hot IR signature for several hours after the vehicle is stopped. The engine takes longer to cool than the rest of the hull. A stationary vehicle engine must be started after long periods of inactivity to keep its battery charged. This situation keeps the IR image hot.

Gun Tube/Barrel

E-108. The gun tube or barrel is another area to look for heat (Figure E-51). When the gun has been fired recently, it appears hotter than its background.

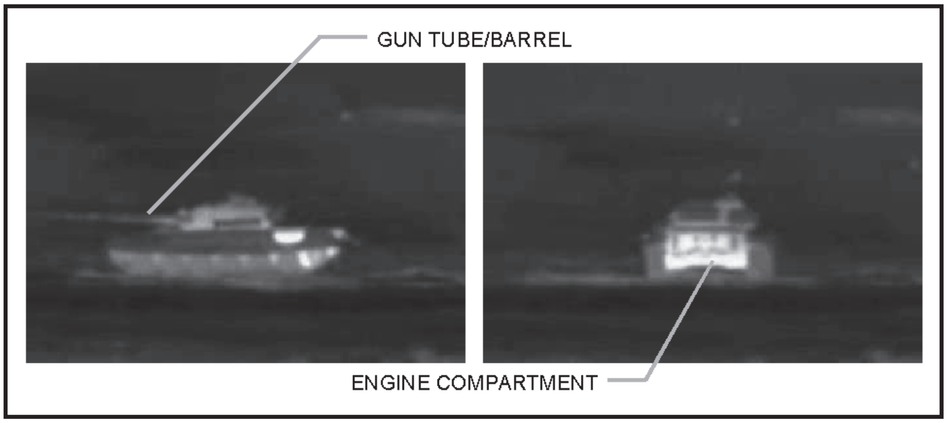
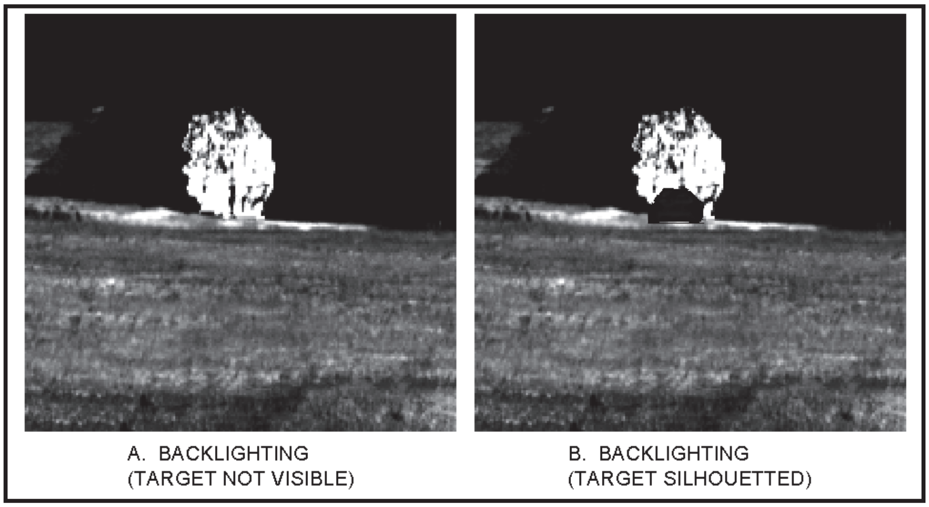


Figure E-51. Engine compartment and gun tube/barrel.

Backlighting

E-109. Backlighting is an indirect IR signature that indicates the presence of a target. It is called an indirect IR signature because, though it is not physically part of the target, it is caused by heat from the target—usually, from the exhaust. Backlighting occurs when an IR source, such as a tank's exhaust, emits IR, which reflects off another object, such as a tree. Even though the gunner may not see a vehicle, backlighting warns him of its presence (Figure E-52A). When the target is between the gunner and the backlighting, the target may appear as a silhouette (Figure E-52B).


A. BACKLIGHTING (TARGET NOT VISIBLE)

B. BACKLIGHTING (TARGET SILHOUETTED)

Figure E-52. Backlighting.

COLD STATIONARY TARGETS

E-110. When the gunner sees a cold stationary target, he can assume there has been no recent activity. A cold target is cooler than its background. It appears as a dark green or black image against a lighter green background. Look for an IR signature that resembles a silhouette of a wheeled or tracked vehicle (Figure E-53).

E-111. To find cold targets easily, adjust contrast up and brightness up so only the coldest signatures appear in the gunner's FOV and the rest of the scene is bright green.

E-112. When the gunner thinks he has detected a target, he adjusts the contrast and the brightness so he can see the rest of the target's features.

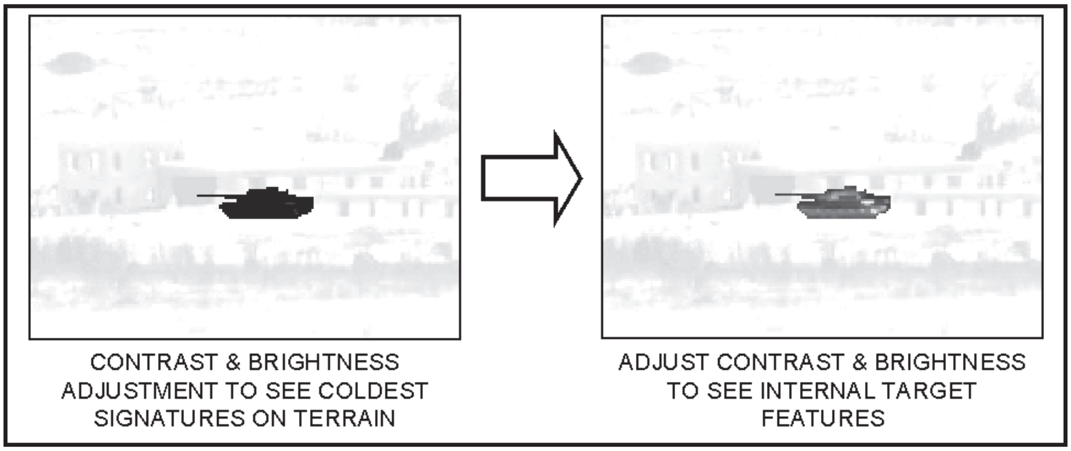

CONTRAST & BRIGHTNESS ADJUSTMENT TO SEE COLDEST SIGNATURES ON TERRAIN
ADJUST CONTRAST & BRIGHTNESS TO SEE INTERNAL TARGET FEATURES

Figure E-53. Image adjustment for detecting cold, stationary targets.

PARTIALLY COOL STATIONARY TARGETS

E-113. When stationary targets are partially cooled, the gunner can assume there has been some activity. Partially cool stationary targets are especially difficult to detect because their signatures are closer to the same temperature as the surrounding terrain. Their signatures also become distorted and incomplete as they cool. This procedure causes the signatures to blend with the background. To find partially cool targets, the gunner has to adjust the contrast and the brightness in various combinations while he scans his sector of fire.

HULL DEFILADE TARGETS (TANKS)

E-114. Hull defilade targets are the most difficult to detect because they are not visible at all times. When a tank is in defilade, it moves back-and-forth between a firing platform and its hide position.

Firing Platform Position

E-115. The tank stays on the firing platform long enough to fire its main gun (Figure E-54A). During the short period of time that it is in this position, the gunner sees only the turret and gun tube. As soon as the tank fires, it moves to its hide position.

Hide Position

E-116. When a tank is in its hide position (Figure E-54B), the gunner cannot see the target, but he may be able to see the tank commander's head.

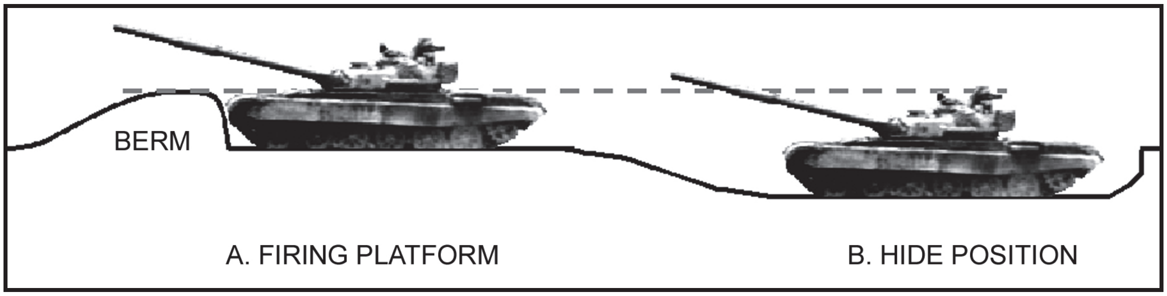


Figure E-54. Tank in defilade.

TARGET CLASSIFICATION

E-117. Once the gunner detects a potential target, he begins the process of elimination to determine the target's classification (Figure E-55).

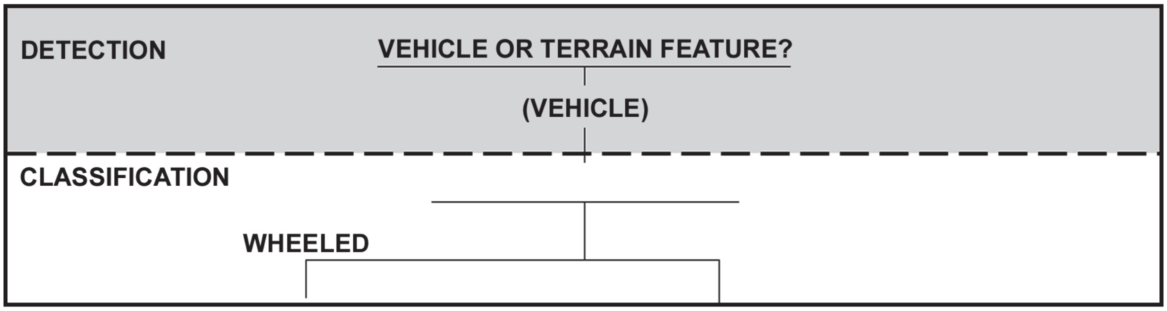


Figure E-55. Target acquisition process—classification step.

CLASSIFICATION FEATURES

E-118. There are specific features that the gunner looks for to classify a vehicle. These features include the suspension system, location of the engine compartment, and presence of a gun tube. Whether or not a feature is visible depends on the target aspect (frontal or flank).

Suspension System

E-119. The suspension type defines the target's classification.

Wheeled Vehicle (Flank)

E-120. A wheeled vehicle has two- to five-round hot spots at its base that appear large compared to the rest of the vehicle (Figure E-56A).

Tracked Vehicle (Flank)

E-121. A tracked vehicle has five- to seven-round hot spots created by the road wheels that look small compared to the rest of the vehicle. The tracks may be visible, and depending on the vehicle configuration, the gunner may see return rollers or skirts (Figure E-56A).

Wheeled and Tracked Vehicles (Frontal)

E-122. On frontal targets, the suspensions for wheeled and tracked vehicles look similar in the NVS (Figure E-56B).

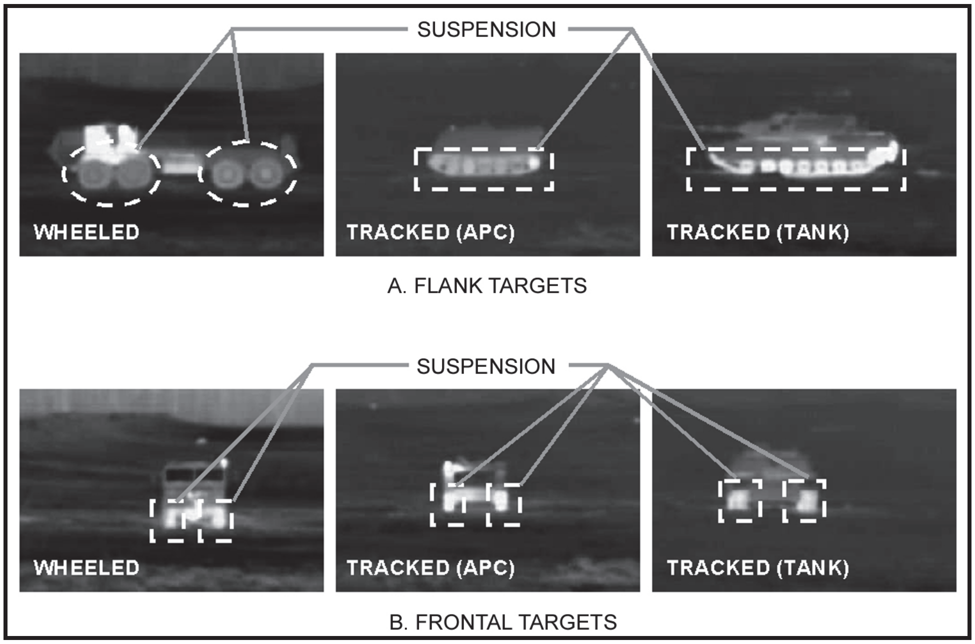

SUSPENSION
WHEELED
TRACKED (APC)
TRACKED (TANK)
A. FLANK TARGETS
SUSPENSION
WHEELED
TRACKED (APC)
TRACKED (TANK)
B. FRONTAL TARGETS

Figure E-56. Classification features—suspension system.

Engine Compartment (Figure E-57)

Wheeled Vehicles

E-123. Generally, the engine on a wheeled vehicle is located at the front.

Tracked Vehicles

E-124. The location of the engine on a tracked vehicle depends on whether the vehicle is a tank or an APC. Tanks have engine compartments located at the rear. APCs generally have engine compartments located at the front.

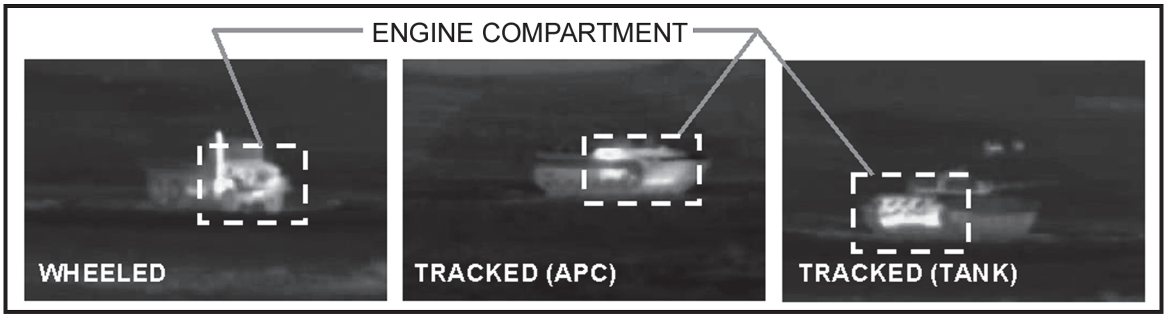

ENGINE COMPARTMENT
WHEELED
TRACKED (APC)
TRACKED (TANK)

Figure E-57. Classification features—engine compartment location.

Gun Tube/Barrel

E-125. When a gun tube or barrel is mounted on a turret or cupola, the Javelin gunner may or may not be able to see it, depending on turret orientation.

Wheeled Vehicle

E-126. In most cases, wheeled vehicles do not have a gun tube, but they may have some type of smaller support gun (machine gun) mounted.

Tracked Vehicle

E-127. When the turret is oriented to the proper angle, the gun tube signature stands out from the turret (Figure E-58).

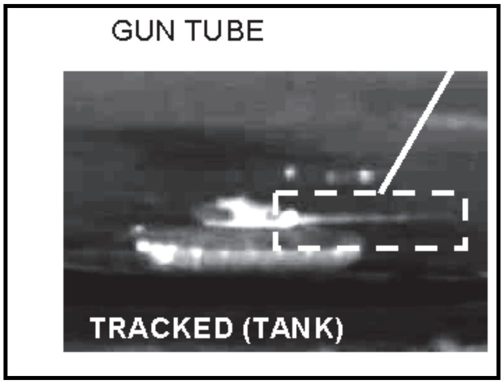


Figure E-58. Classification features—gun tube/barrel.

NOTE: Proper adjustment of focus, contrast, and brightness enables the gunner to classify and recognize targets. Adjust the image so the target features stand out from the surrounding terrain features. It may be necessary to make several adjustments for the same target. See Figure E-59 for examples of poorly adjusted and properly adjusted target images for classification and recognition.

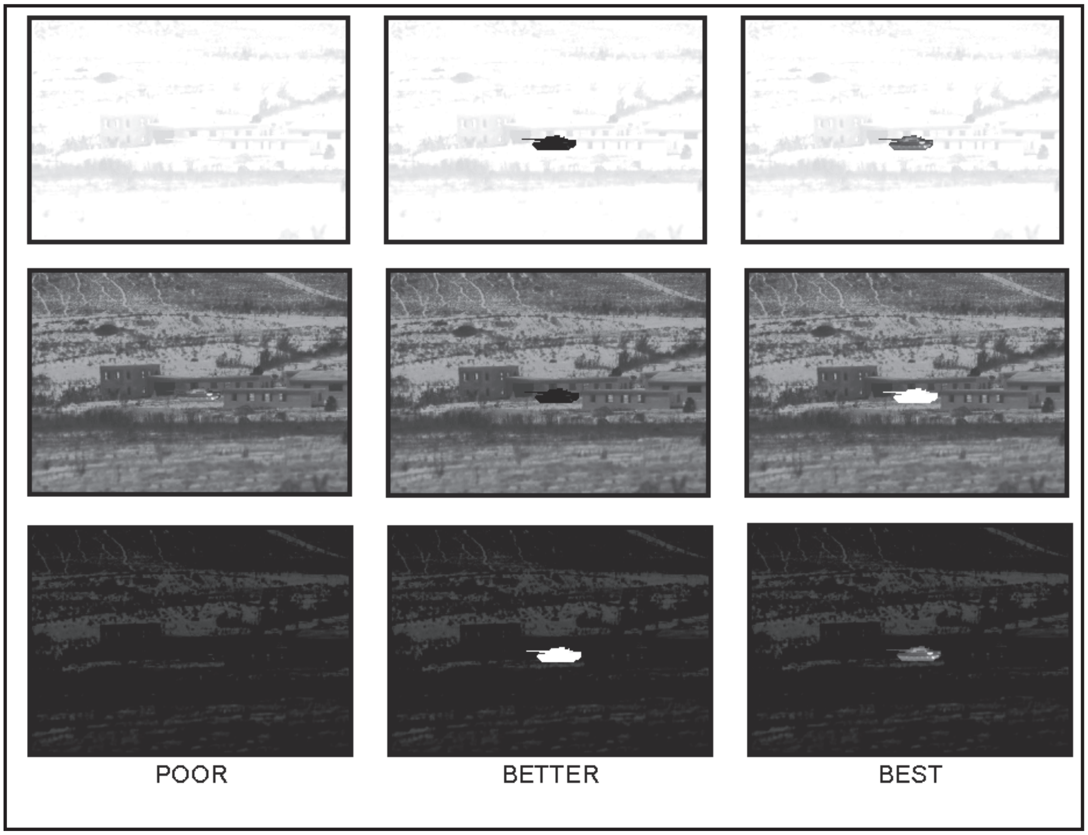


Figure E-59. Image adjustments for target classification and recognition.

DEFENSIVE OPERATIONS (MOVING TARGETS)

E-128. Some targets may be easier to classify and recognize than others for the following reasons:

Range to the Target

E-129. Even under ideal conditions, classifying and recognizing a target at long ranges is difficult due to the NVS magnification and image resolution. As range to the target decreases, target details become clearer, which makes classification and recognition easier.

Target Aspect

E-130. Flank targets are easier to classify and recognize than frontal targets (Figure E-60). The profile exposes the suspension and other distinctive features, such as turrets, engine compartments, gun tubes, or other armament.

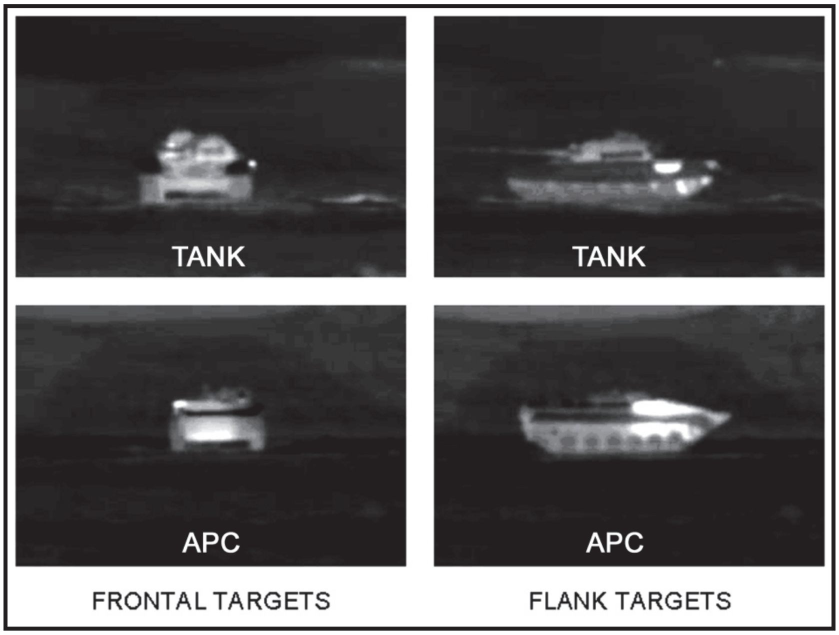


Figure E-60. Classification and recognition features of flank and frontal targets.

Target Movement

E-131. A moving target allows the gunner to see it from more than one aspect making it easier to classify and recognize than a frontal target moving in a straight line.

Terrain

E-132. Targets try to remain hidden from the gunner by staying in cover and concealment, or by using the terrain to mask their movement. Depending on the amount of terrain masking, the gunner may see only one or two features from which to classify, and recognize a target.

OFFENSIVE OPERATIONS (STATIONARY TARGETS)

E-133. The gunner's ability to detect, classify, and recognize a stationary target depends on:

- Position of the target with respect to the gunner's location.
- Enemy activity.
- Proper image adjustment.
- Amount of target exposure.

TARGET RECOGNITION

E-134. Target recognition is the next step in the process of elimination whether a tracked vehicle is a tank.

DEFINITION

E-135. Target recognition: to determine whether a tracked vehicle is a tank or an APC (Figure E-61).

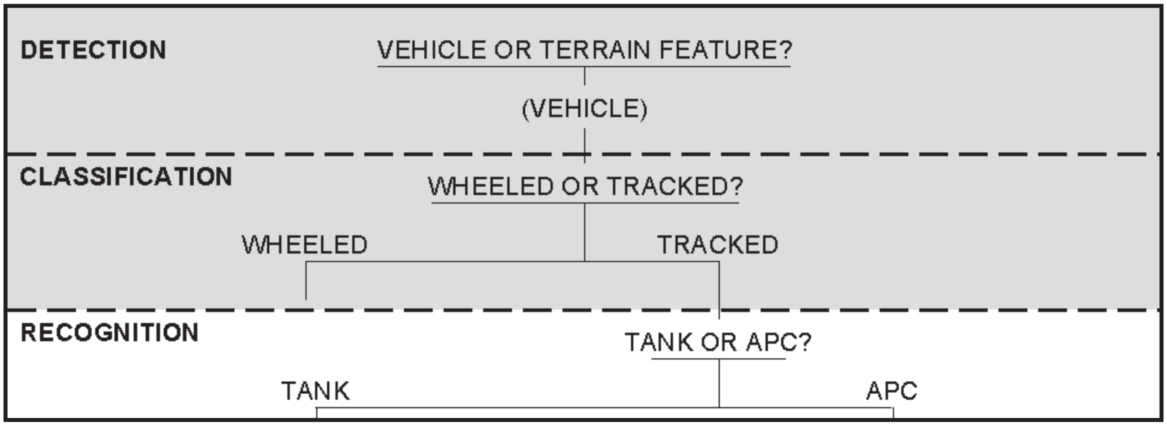

DETECTION
VEHICLE OR TERRAIN FEATURE?
(VEHICLE)
CLASSIFICATION
WHEELED OR TRACKED?
WHEELED
TRACKED
RECOGNITION
TANK OR APC?
TANK
APC

Figure E-61. Target acquisition process—recognition step.

IMAGE ADJUSTMENT

E-136. Image adjustment for target recognition is the same as for classification. The gunner should make image adjustments so the target features stand out from the surrounding terrain features. The gunner may have to keep adjusting contrast and brightness to bring out different target details as he tries to attempts target recognition.

RECOGNITION FEATURES

E-137. The major differences between tanks and APCs are shown in Figure E-62 and Table E-1.

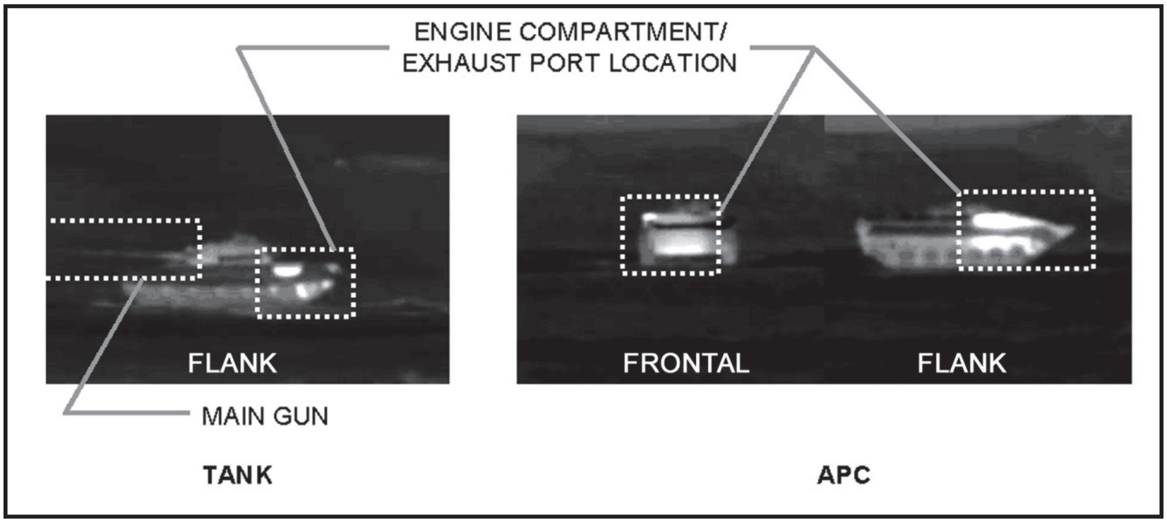

ENGINE COMPARTMENT/
EXHAUST PORT LOCATION
FLANK
MAIN GUN
FRONTAL
FLANK
TANK
APC

Figure E-62. Target recognition features.

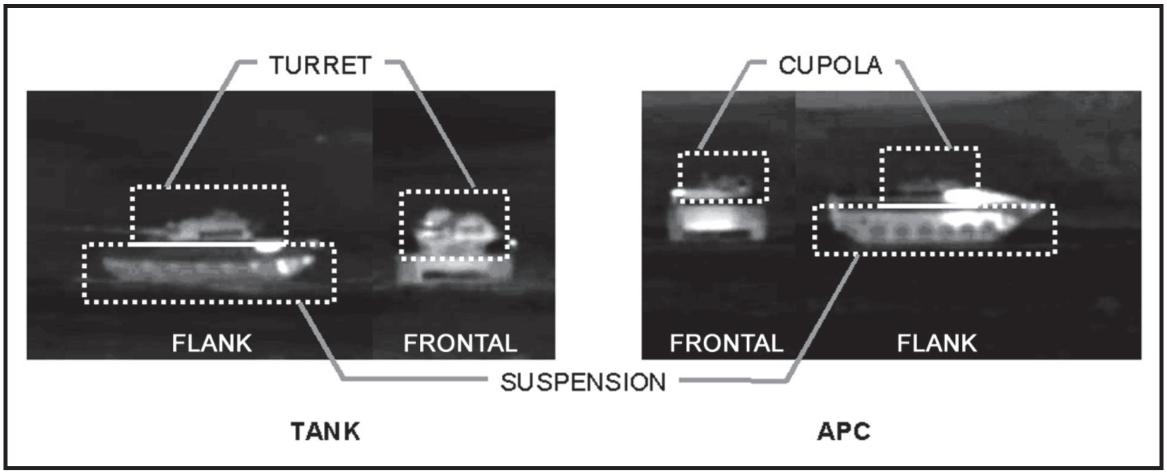

TURRET
CUPOLA
FLANK
FRONTAL
FRONTAL
FLANK
SUSPENSION
TANK
APC

Figure E-62. Target recognition features (continued).

Table E-1. Target recognition features.

SIGNATURE	TANK	APC
Engine Compartment	Located In Rear	Located In Front
Exhaust Ports	Located In Rear	Located In Front Or On The Side
Main Gun	Long And Thick	Short And Thin
Turret	Yes - And Large	Yes, Most Have Turrets
Cupola	New Tanks—No Old Tanks—Yes	Yes—Usually Small
Size/Shape	Large And Sloping	Small And Rectangular

Glossary

Section I. ACRONYMS AND ABBREVIATIONS

AA	avenue of approach
AAR	after-action review
ACU	Army combat uniform
APC	armored personnel carrier
ARNG	Army National Guard
ARNGUS	Army National Guard of the United States
ARTEP	Army Training and Evaluation Program
ASI	additional skill identifier
ASIP	advanced systems improvement program
BCU	battery coolant unit
BDA	battle damage assessment
BFV	Bradley fighting vehicle
BIT	built-in test
BMP	fighting vehicle manufactured by the former Soviet Union
BNCOC	Basic Noncommissioned Officer Course
BST	basic skills trainer
CARC	chemical-agent resistant coating
CBRN	chemical, biological, radiological, nuclear
CD-ROM	compact disk read-only memory
CGP	commander's ground pointer
CLU	command launch unit
CU	control unit
CVI	combat vehicle identification
DDC	detector dewar cooler
DLIC	detachment left in contact
DRC	daily readiness check
EMI	electromagnetic interference
ESAF	electronic safe, arm, and fire
FM	field manual
FNC	fiber nickel cadmium
FOV	field-of-view
FTT	field tactical trainer
FTX	field training exercise
GRP	gunner's reference point
GST	gunner's skill test
GTA	graphic training aid
HE	high-explosive
HMMWV	high-mobility multipurpose wheeled vehicle
I2R	imaging infrared
IAW	in accordance with
IEDK	individual equipment decontamination kit
IFV	Infantry fighting vehicle

IR	infrared
JGC	Javelin Gunner's Course
LD	line of departure
LED	light-emitting diode
LL	left limit
LTA	launch tube assembly
MEL	maximum engagement line
METL	mission-essential task list
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, civil considerations
MILES	multiple integrated laser engagement system
MRE	meals ready-to-eat
MSR	missile simulation round
MTP	mission training plan
NCO	noncommissioned officer
NCOES	Noncommissioned Officer Education System
NFOV	narrow field-of-view
NSN	national stock number
NVG	night vision goggles
NVS	night vision sight
OES	Officer Education System
PE	practice exercise
PMCS	preventive maintenance checks and services
POI	program of instruction
RL	right limit
ROC-V	Recognition of Combat—Vehicles
ROE	rules of engagement
SAAF	small-arms alignment fixture
SBCT	Stryker brigade combat team
SBCU	simulated battery coolant unit
SCLU	simulated command launch unit
SDK	skin decontamination kit
SINCGARS	single-channel ground and airborne radio system
SOP	standing operating procedure
STP	Soldier's training publication
STX	situational training exercise
TDC	Training Device Course
TEWT	tactical exercises without troops
TM	technical manual
TOE	table of organization and equipment
TOW	tube-launched, optically tracked, wire-guided missile
TRP	target reference point
TSC	training support center
USAIS	United States Army Infantry School
USAR	United States Army Reserve

VCR	video camera recorder
WFOV	wide field-of-view

Section II. DEFINITIONS

ΔT	Delta (Δ) is a Greek letter that stands for change or difference. T stands for temperature.
absorbers	Protect CLU from damage during handling and movement.
aft end cap	Protects the round from damage during handling and movement; permanently attached to round.
ATTK SEL	Attack select. Switches between the top attack mode and the direct attack mode.
backlighting	Indirect IR signature that indicates the presence of a target.
basic skills trainer	An indoor/shipboard training device that can train and test the gunner's skills in a wide variety of situations.
battery coolant unit	Provides electrical power and seeker cooling for the missile.
carry handle	Used to lift and carry the round.
CLU interface connector	Provides electrical interface with the round.
CTRS	Contrast. The contrast is adjusted by moving the GATE ADJ/CTRS and BRT switch horizontally (left and right).
daysight	Optical system that works similar to a telescope. Develops a magnified, visible-light target image for the gunner.
desiccant	Used to prevent moisture from gathering in the missile and causing possible missile malfunctions. It is located inside forward end cap.
DFOV	Day field-of-view. The power switch is in the DAY position, the Javelin is in mode. The status indicator located on the CLU display. This appears as a green indicator light when the day FOV is selected.
DIR	Direct attack mode. When the DIR indicator light is lit the direct attack mode is selected.
elapsed time meter	Records total operating hours of CLU. It is located in battery compartment.
electronic safe, arm, and fire	Controls arming and ignition of the missile motors, arming, and detonation of the warhead charges.
eyepiece	Allows viewing of CLU display image. Contains diopter adjust ring that gunner uses to focus CLU display image, eyecup.

face shield absorber	Shields gunner's face from possible launch debris and helps protect CLU from damage during handling and movement.
field tactical trainer	Designed to be used as an outdoor trainer and is equipped with the MILES.
fire trigger	Used to initiate missile firing sequence.
FLTR SEL switch	Filter select. The filter select switch is used to select the night vision sight (NVS) filter. The NVS filter prevents the CLU from being detected by enemy countermeasures.
FOC ADJ switch	Focal adjust. Used to adjust the focus of the CLU display image during NVS (NFOV or WFOV) operation.
forward end cap	Protects the round from damage during handling and movement. It provides environmental and electromagnetic interference (EMI) protection for the missile. It is removed prior to missile firing.
GATE ADJ/CTRS and BRT	Gate adjust/contrast and brightness. It serves two functions depending on whether the CLU display image is from the NVS or the seeker. In the NVS mode the controls adjusts the brightness and contrast. In the seeker mode the controls control the track gates by moving them in or out horizontally and vertically.
humidity indicator	Displays status of relative humidity inside CLU. It is located on right side of CLU. It displays the status of relative humidity inside LTA. Located on the forward end cap.
latch assembly	Latch assembly together with the alignment fork and latch release provides the mechanical interface with the CLU.
launch tube assembly	Serves as a handling container and launch platform for the missile. Provides environmental and electromagnetic interference (EMI) protection for the missile.
left handgrip controls	Consists of focus adjust (FOC ADJ), sight select (SGT SEL), and filter select (FLTR SEL) switches.
lock-on	Simulated seeker lock-on has been commanded.
locking pin	Locks the forward end cap latch in place and prevents movement.
missile simulation round	Simulates the weight and balance of the round and has CLU and BCU connectors.
night vision sight	Optical system that converts an IR target image into a visible-light target image for the gunner.
power switch	Four-position rotary switch used to place the Javelin into operation.
right handgrip controls	Consists of gate adjust (GATE ADJ), contrast and brightness (CTRS and BRT), and attack select (ATTK SEL) switches.
round interface bracket	Round interface bracket together with the alignment pin and round interface catch provide the mechanical interface with round.

round interface connector	Provides electrical interface with the CLU.
seeker trigger	Used to initiate seeker mode of operation and seeker lock-on.
SGT SEL	Sight Select. Is used to select day FOV, WFOV, NFOV, or seeker FOV.
shoulder pad	Provides point of balance and support when round is placed on gunner's shoulder.
shoulder strap	Provides a means of carrying the round. Can be placed on gunner's shoulder or diagonally across chest.

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